NOVEMBER 29, 1954

Washington Comment . . . . . *page 94*

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

On Richmond's Hull Street Virginia Electric & Power Co finds . . .

Banked Secondaries:

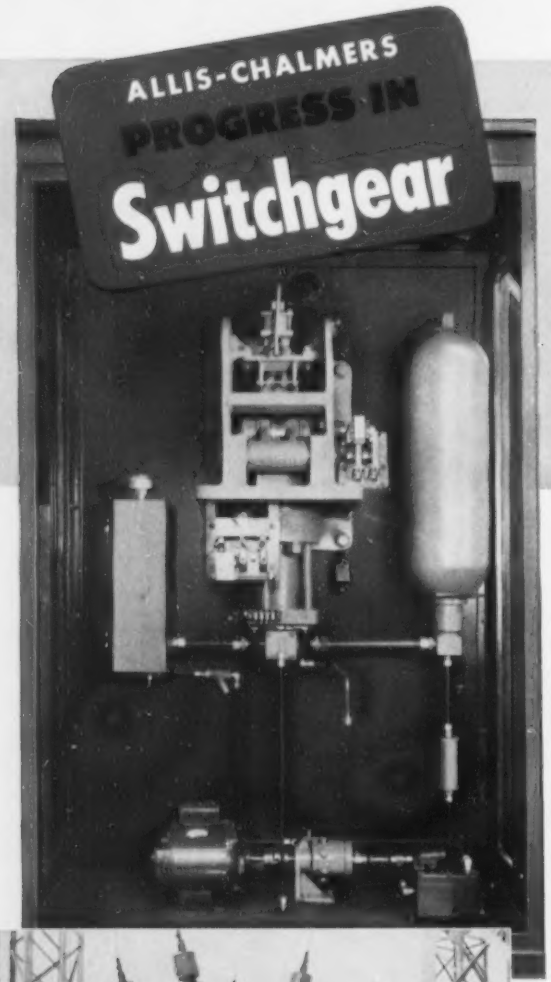
- *Reduce costs*
- *Better service*
- *Improve appearance* *See page 72*

230-Kv Pipe-Type Cable Supplies Sao Paulo . . . . . page 76

Modern Power Dispatch Evaluates Line Losses . . . . . page 80

"Pneu-Draulic" Operating Mechanism for Breakers

Looks Simple...IS SIMPLE!



Only 1 adjustment in hydraulic system...
to position the spool valve.

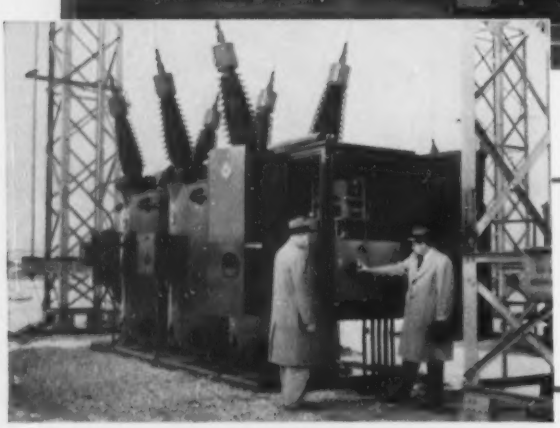
Only 2 moving parts in hydraulic control...
the spool valve and its control.

This simplicity of design was an important factor in the performance of *Pneu-Draulic* operators during the past year at an eastern power company. But this is only one part of the story of simplicity. It's simple to maintain as well.

Note the wide open accessibility — the short lengths of pipe — the few parts. In addition, the system eliminates basic causes for maintenance. Dirt hazard is eliminated. In effect, it's a sealed system with efficient filtering. Corrosion problems are reduced, since oil in the system uses one of the best corrosion inhibitors known. Moisture condensation problems are eliminated, since the system is filled with oil. Even manual closing is simpler, because provision for manual closing is built in.

Find out more about the breakers with the *Pneu-Draulic* operating mechanism. Call your nearby A-C office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4375

Pneu-Draulic is an Allis-Chalmers trademark.



New Operator Mechanism Has Excellent Record

Four 115-kv Allis-Chalmers circuit breakers at an eastern power company have operated almost a year with a total of over 4000 operations.

ALLIS-CHALMERS

A-C ALLIS CHALMERS

Electrical World

Vol 142 No. 22 November 29, 1954

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ELECTRICAL WORLD

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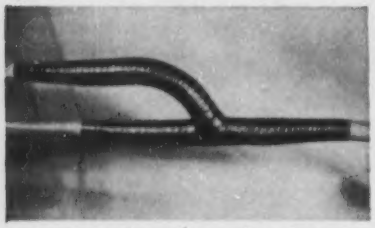
UNUSUAL BRANCH CONNECTOR Saves Manhole Wall Space

With all the remarkable synthetic fibers appearing on the market, a lot of new plants are going up to manufacture them. One of the biggest plants ordered 28,000 feet of Okolite-Okoprene cable for its underground primary distribution system.



One of the interesting features of this big installation was their method of saving manhole wall space—an important consideration in all underground work. Since the cable was about 2" in diameter, it would have required around 24" space for training the tap, if a regular Tee joint was used.

Instead Okonite engineers worked out a preformed branch connector, in cooperation with a fitting manufacturer. From the picture you can see that by forming the connector instead of bending the cable the radius of bend was cut in half. Q.E.D.: only half as much manhole wall space was required.

Engineers at this plant weren't taking any chances with their cables . . . and they weren't taking any chances with their splices either. They made all their splices with Okolite, Manson and Okoprene tape.

It's good sense and good business to use a better tape and obtain a joint that's "spliced for life." The tape represents only a small fraction of the total cost of the job.

Why not send for a set of instruction sheets, EW-5678; you'll find them helpful.

. . . when you splice with:

AVAILABLE THROUGH AUTHORIZED DISTRIBUTORS ONLY

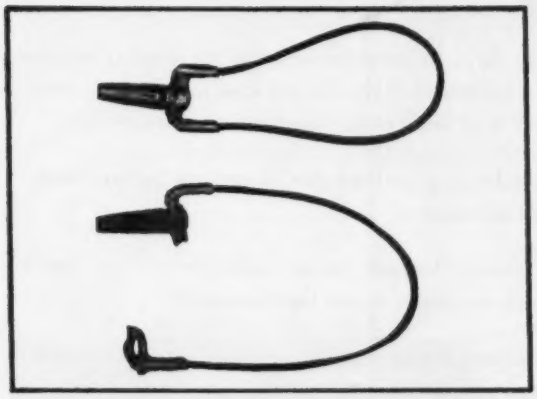
1441

Made by
THE OKONITE COMPANY
PASSAIC NEW JERSEY
SINCE 1878

SPECIALISTS IN ELECTRICAL WIRES, CABLES AND SPLICING MATERIALS FOR 75 YEARS

Electroline AUTOMATIC DEAD-END

for Neutral Supported Multiple Conductor Service-Drop Cable



THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

WRITE FOR NEW BULLETINS FOR FULL INFORMATION

TALENT TO ORIGINATE E ABILITY TO PRODUCE

Electroline Company

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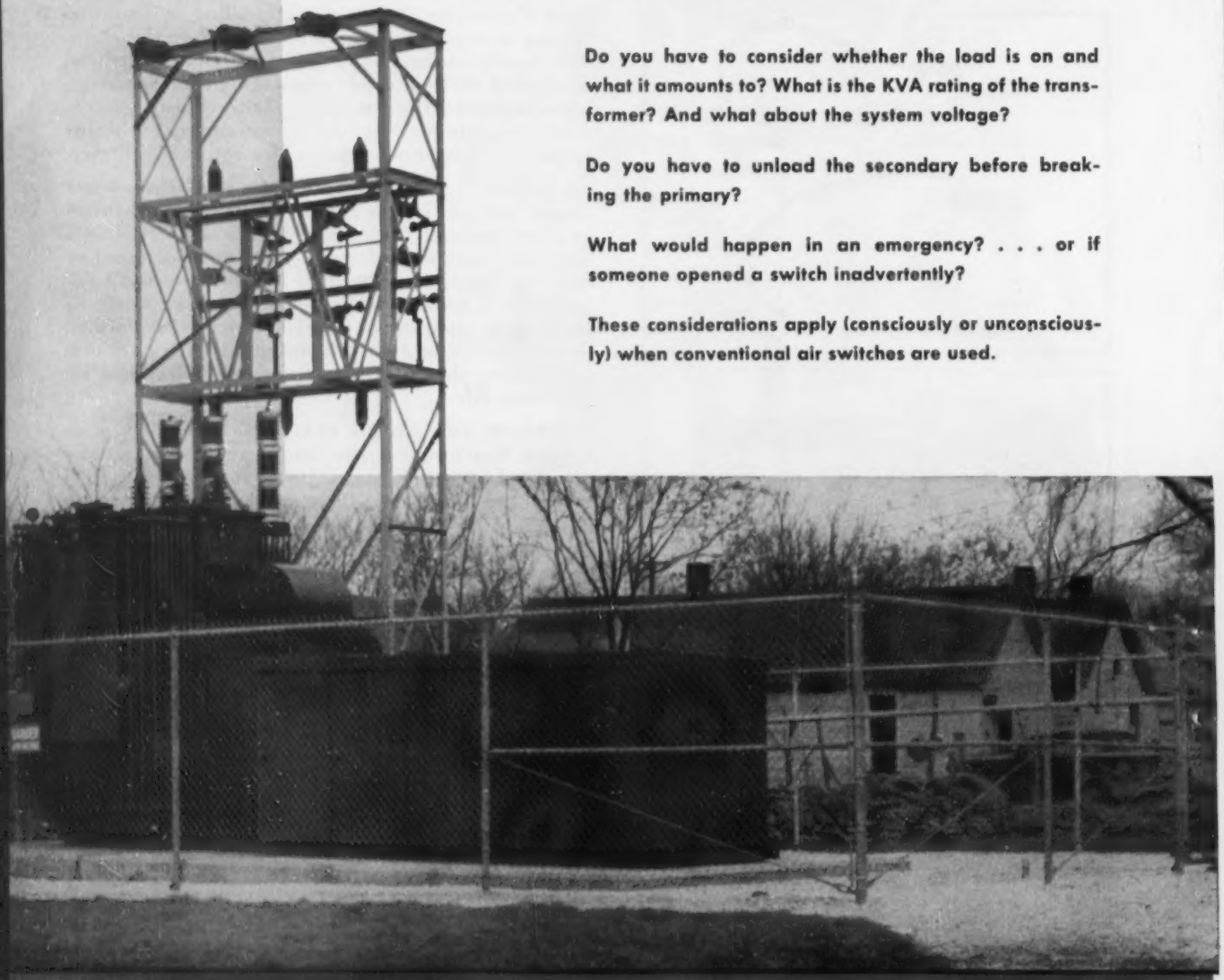
In Your Distribution Substations

WHAT DOES IT TAKE

to Switch the Primary?



Do you have to consider whether the load is on and what it amounts to? What is the KVA rating of the transformer? And what about the system voltage?

Do you have to unload the secondary before breaking the primary?

What would happen in an emergency? . . . or if someone opened a switch inadvertently?

These considerations apply (consciously or unconsciously) when conventional air switches are used.

SPECIALISTS IN HIGH-VOLTAGE

The S&C LOAD INTERRUPTER takes nothing but a pull on the handle

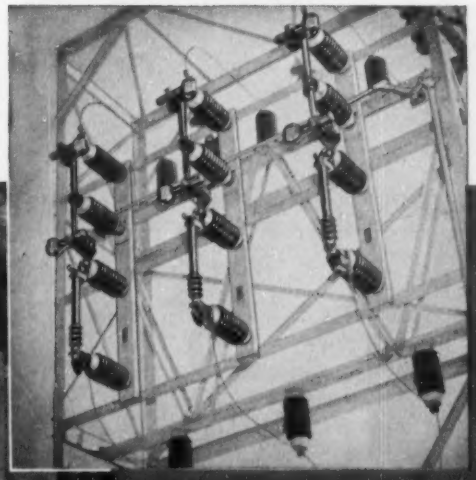
● The S&C Load Interrupter (Alduti Type) can break the primary circuit of a distribution substation any time under any condition (except short circuit). Switching cannot lead to dangerous phase-to-phase or phase-to-ground faults. It cannot endanger men or equipment.

● When you break the magnetizing current, the break is positive—clean—decisive. (You don't have to "dog" it as a preliminary.) You are completely independent of wind velocity and wind direction.

● Then too you can break the magnetizing current of the larger transformers—an impossibility with conventional air switches.

● Under emergency conditions—or for protection against inadvertent operation—you can interrupt the entire load current of the substation. Thus you have two ways to drop the load—on either primary or secondary.

Do you have these operating advantages at your substations?



Inset shows a close-up of S&C Load Interrupters in service on the primary of a typical distribution substation.

S&C Interrupters bring new concepts of operating convenience, and new thinking in system layout. We will gladly send you this booklet containing detailed information about them.

S&C

ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
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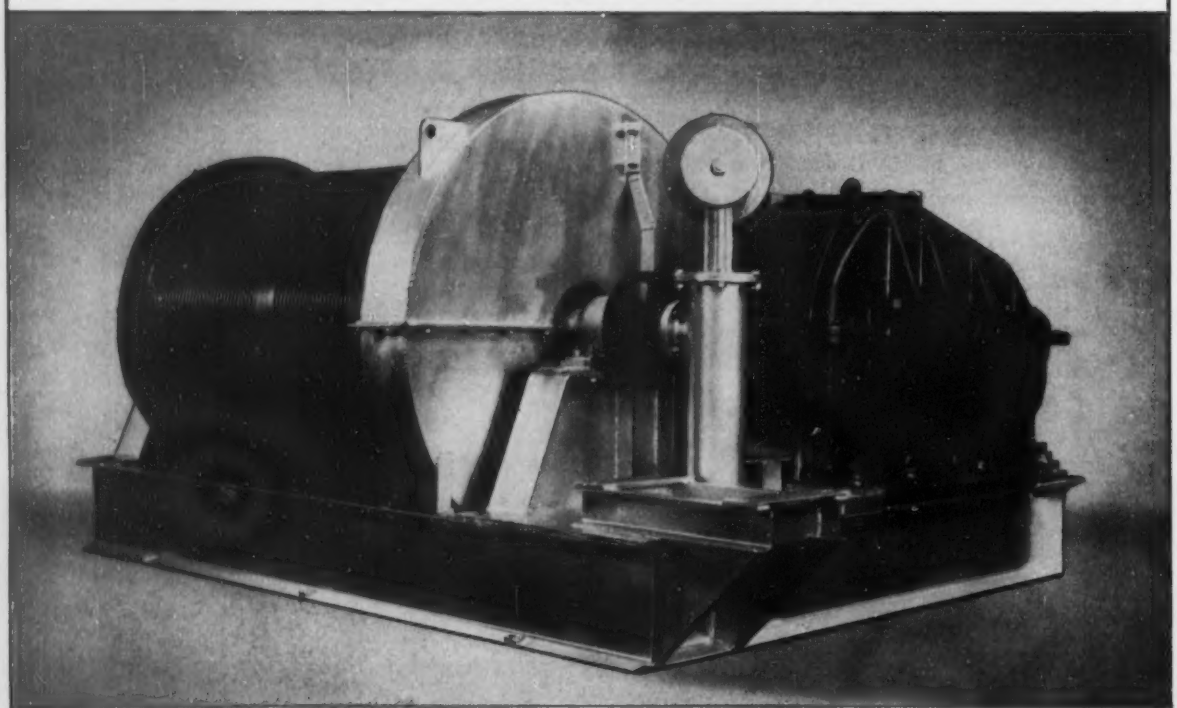
CIRCUIT INTERRUPTION

INTAKE GATE HOIST

built by **PACECO**

"TAILORS OF STEEL"®



Southern California Edison Company, Big Creek, California

Built to handle the 8′ x 17′8″ intake wheel gates at entrance to penstock, hoists lift at 2.75′ per min. Hoists are arranged for hand or gasoline motor emergency operation. Control is by means of push buttons mounted on the hoist unit. All parts are of welded steel construction mounted on a rigid welded steel frame.

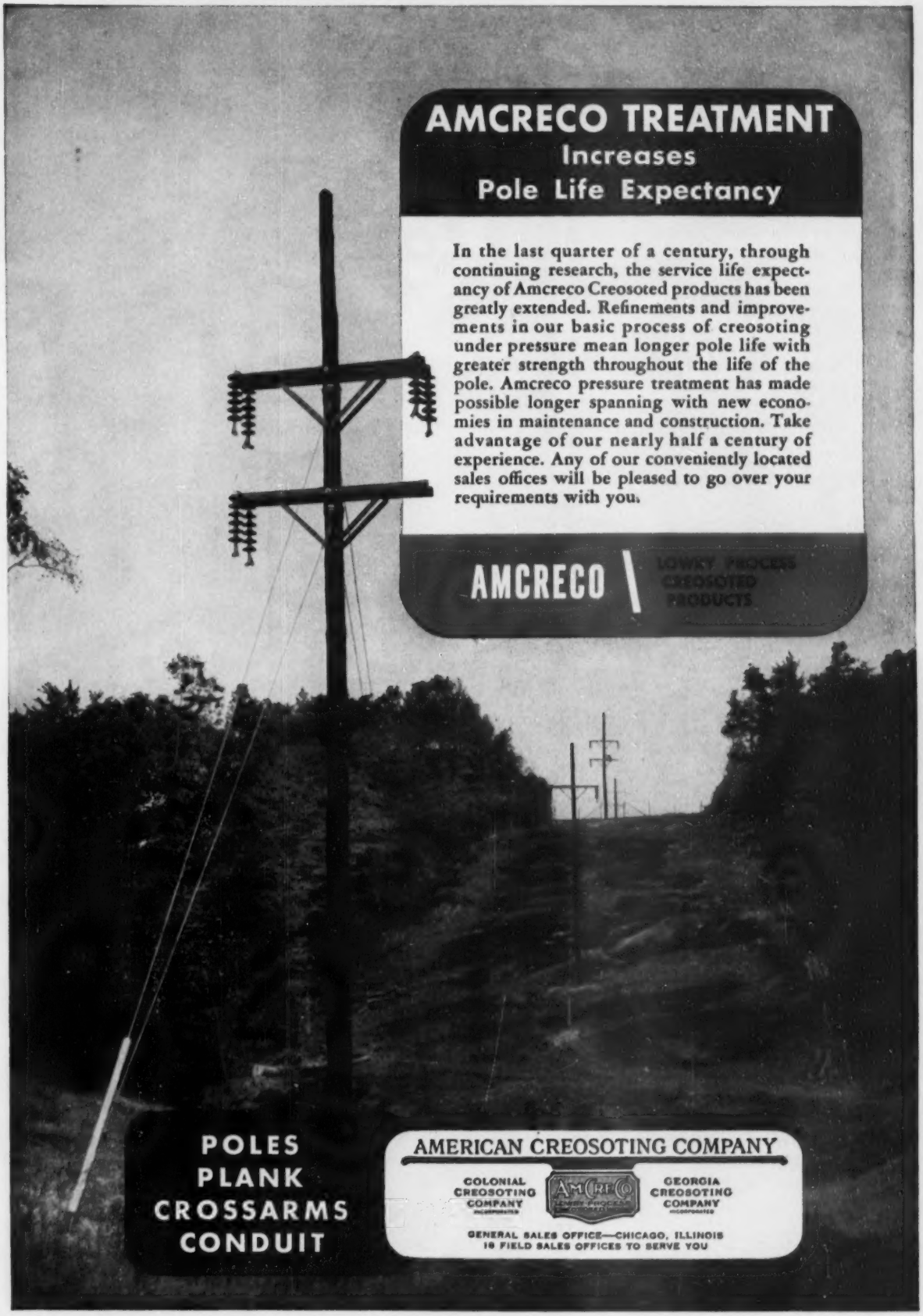
Pacific Coast Engineering Company invites your inquiries when your needs fall within our scope of service, including cranes, gates, hoists, penstocks, pipe, valves and other units requiring skilled fabrication of metal plate and precision machine work.

One job . . . one responsibility.

PACIFIC COAST ENGINEERING COMPANY

Alameda, California

ENGINEERS • MACHINISTS • FABRICATORS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In the last quarter of a century, through continuing research, the service life expectancy of Amcreco Creosoted products has been greatly extended. Refinements and improvements in our basic process of creosoting under pressure mean longer pole life with greater strength throughout the life of the pole. Amcreco pressure treatment has made possible longer spanning with new economies in maintenance and construction. Take advantage of our nearly half a century of experience. Any of our conveniently located sales offices will be pleased to go over your requirements with you.
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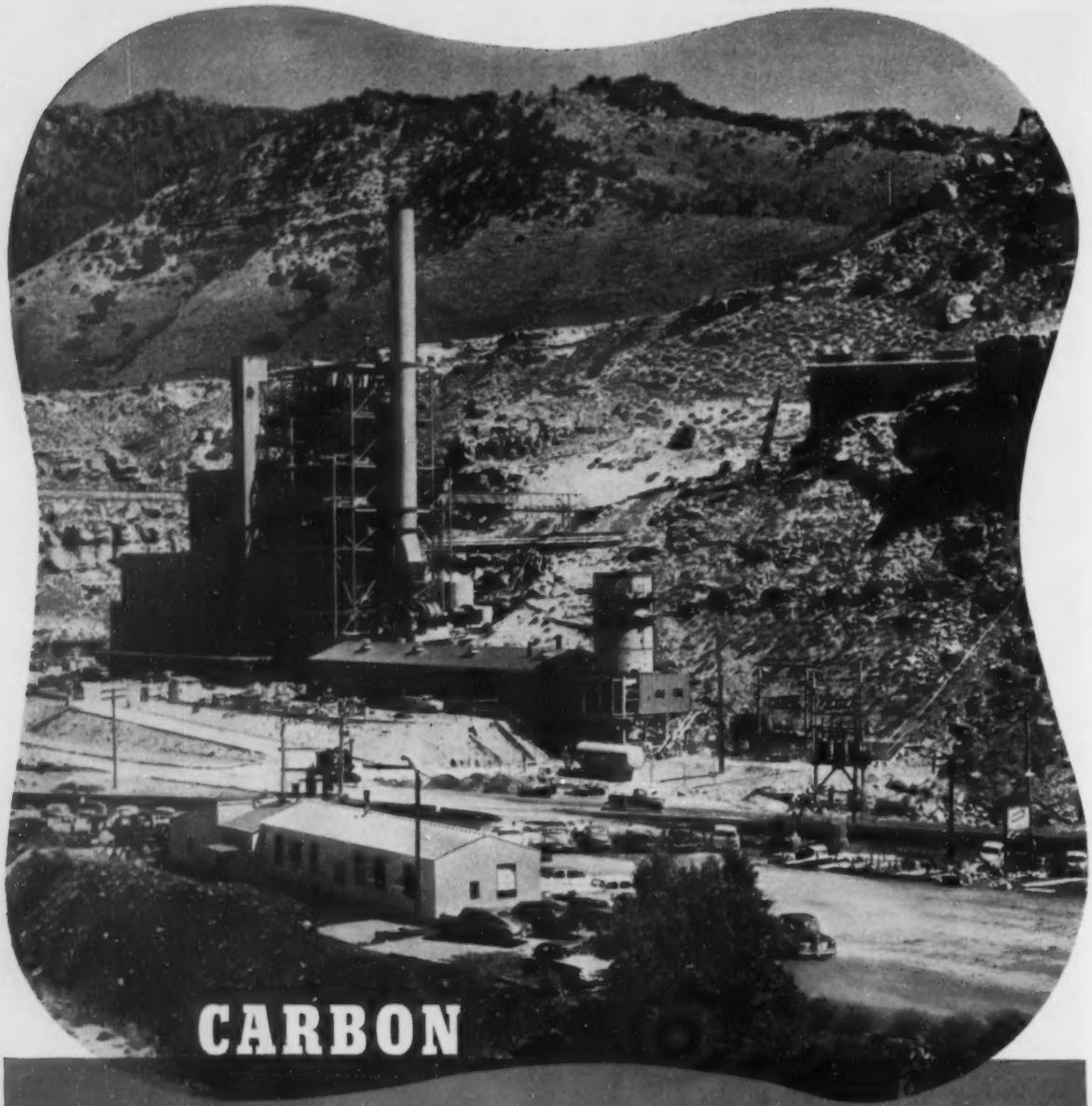
10 FIELD SALES OFFICES TO SERVE YOU



. . . Mine Mouth Power Plant

The completion of the 66,000 kilowatt Carbon Steam Plant at Castle Gate adds another important facility to the expanding system of Utah Power & Light Company.

The Carbon plant is appropriately named. Surrounded by commercial coal deposits, it has been designed to utilize this abundant fuel supply in an economical and efficient operation.

In a program that is supplying "more power to more people," UP&L placed responsibility for the Carbon Steam Plant with Bechtel—design through construction. It is one of four consecutive contracts by Bechtel for this utility.

BUILDERS FOR INDUSTRY

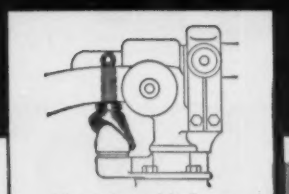
BECHTEL

BECHTEL CORPORATION

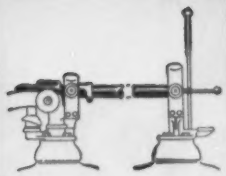
Los Angeles • **SAN FRANCISCO** • *New York*

ONLY 3 MOVING ELEMENTS

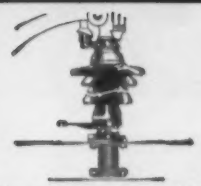
Operate the type WAG high pressure switch



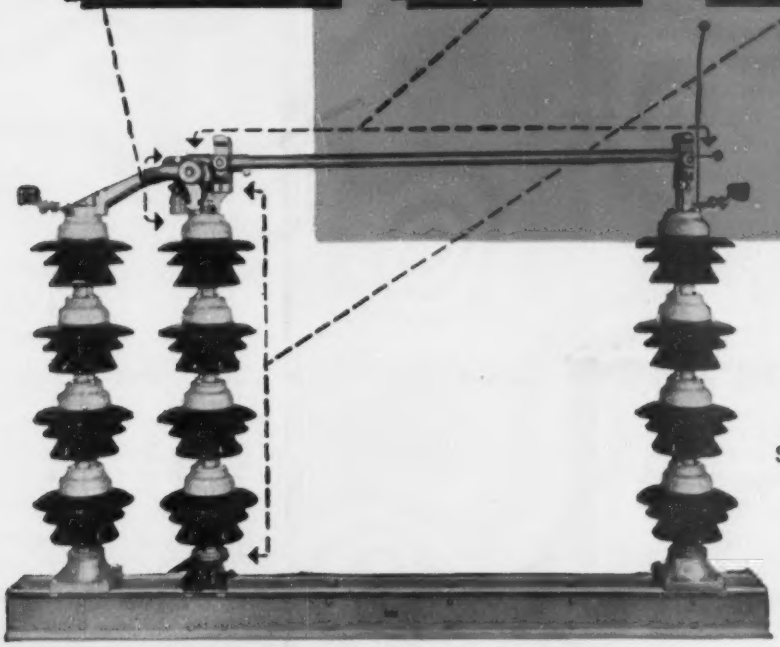
1 The universal link connecting the crank arm and the blade assembly.



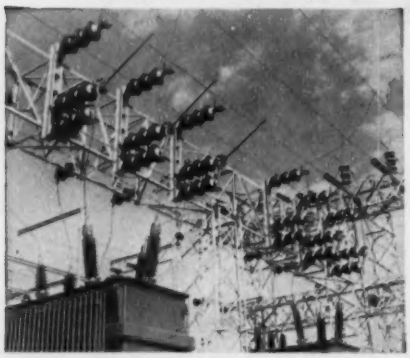
2 The blade assembly.



3 The center rotating insulator, bearing, and the crank arm affixed to the top.



AMPLITACT CONTACTS ARE AVAILABLE TO MEET UNUSUALLY HIGH SHORT CIRCUIT CURRENTS.



An extremely simple operating mechanism gives the Type WAG High Pressure Air Break Switch a superior mechanical advantage, which assures complete dependability under all climatic, operating, and atmospheric conditions—a fact proved by years of continuous service on applications in every section of the nation. The three moving elements are factory set to preclude any possibility of maladjustment.

Ease of operation, positive blade control, high contact pressure and wide contact deflection, plus a host of other outstanding features add up to unsurpassed performance and economy. Get all the facts in Bulletin 390-R, which we'll gladly send on request. Then you, too, will specify Southern States Type WAG Switches.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

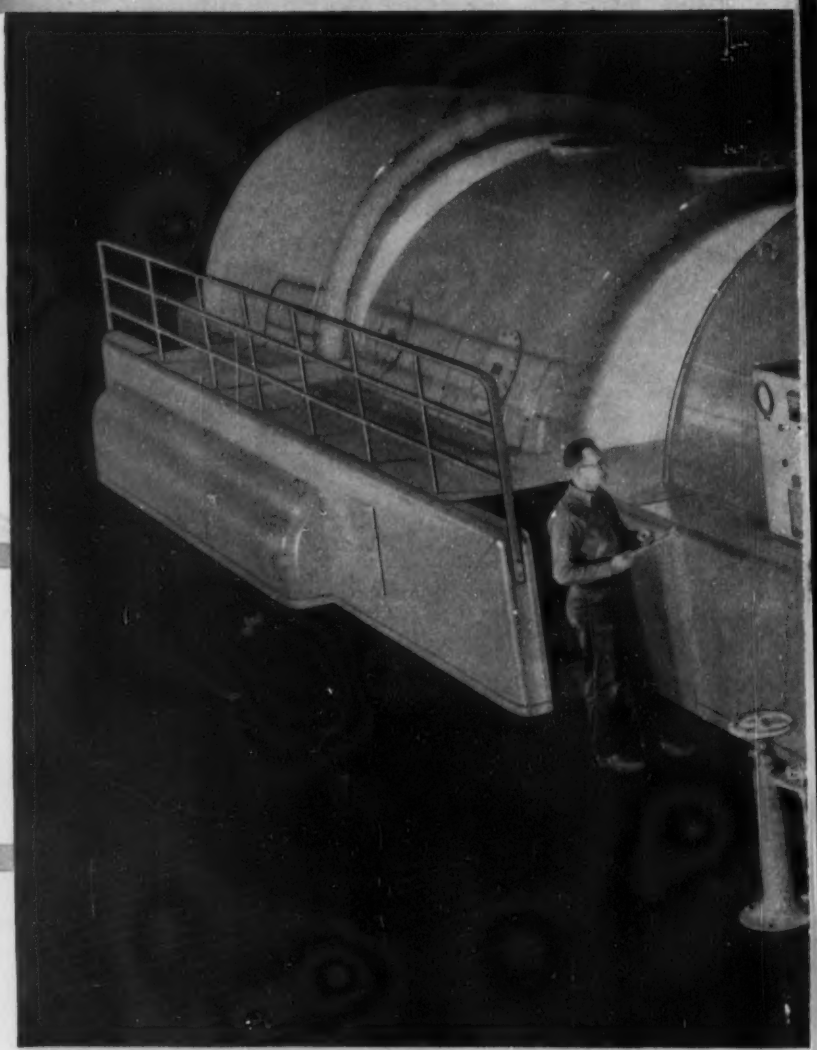
4 OPERATION-PROVED OF *Super*

1 **Save on Plant Costs.** A steam turbine generator unit with supercharged cooling produces significant savings both in area of plant and in foundation design. For example, in total plant space a 150-mw unit will require 20 feet less because rotor-removal distance is shorter than that of conventionally cooled units. In foundation length at least 10 feet can be saved, and foundation loading is reduced because stator weight is only a fraction of that for conventional cooling. The corresponding reduction in crane span and lifting capacity affords further savings.

2 **Save Switchgear Costs.** Savings are possible because of higher reactances and consequently lower fault currents. The 2-pole fully supercharged machine has reactances almost identical to those of a large 4-pole generator.

3 **Reduce Conductor Expansion . . .** because the axial length of the generator is much less than that of a conventionally cooled machine. In addition, the average and differential temperatures are lower.

4 **Simplified Installation and Inspection.** Light weight and compact design facilitate handling, reduce bearing and seal size. Oil and gas requirements are minimized.

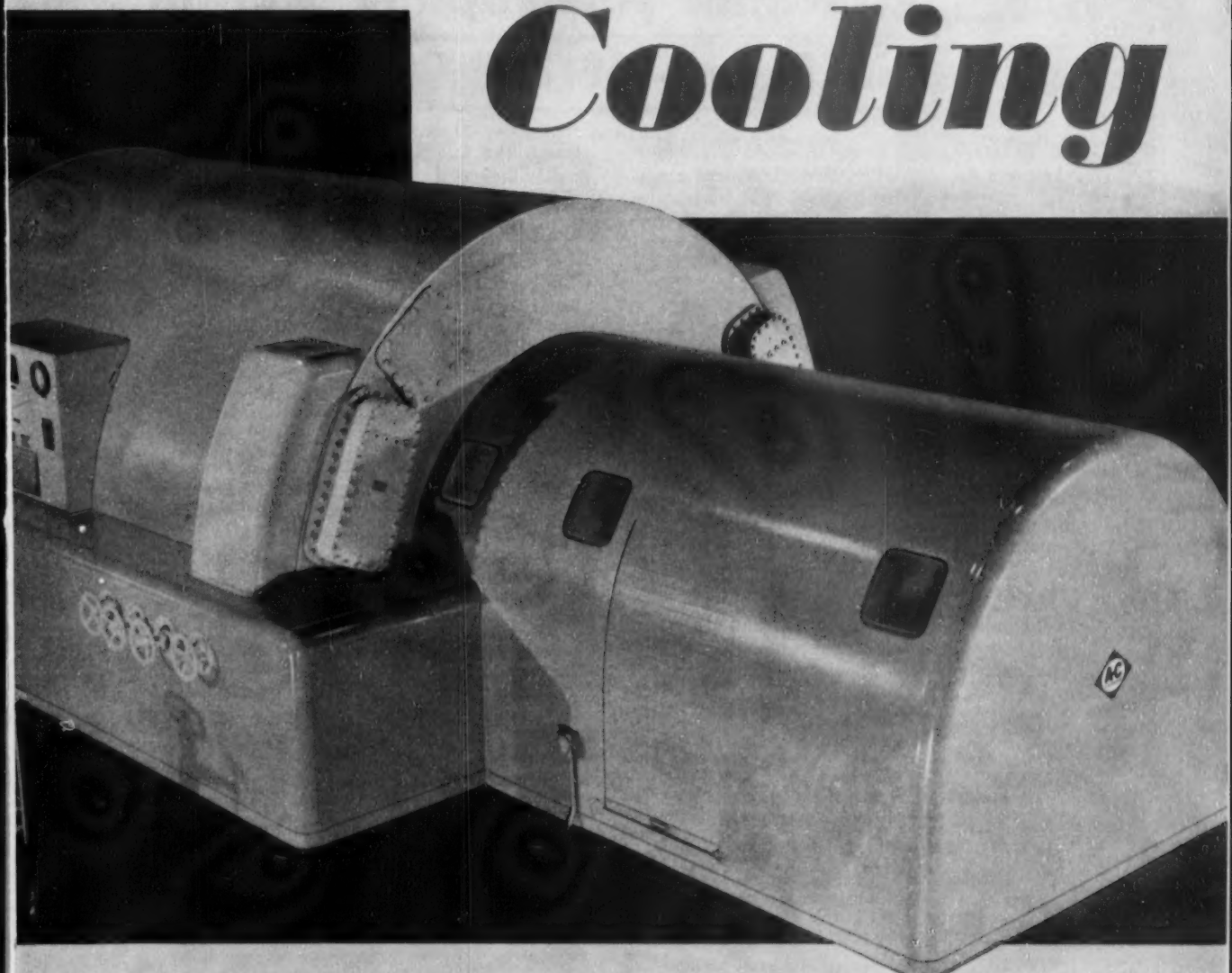


For units of present-day capacities, like the steam turbine generator unit shown above, supercharged cooling has proved a means for providing important economies. In addition, operation of these units since 1951 shows that

LIGHT FOR FREEDOM · LIGHT'S DIAMOND JUBILEE · POWER FOR PROGRESS

ALLIS-

ADVANTAGES *charged Cooling*



this Allis-Chalmers pioneered development lifts the lid off future increases to higher capacities.

Supercharged cooling by Allis-Chalmers combines conductor-cooling with high velocity scrubbing action of gas over ample exposed area. Developments like this prove you can count on Allis-Chalmers for pace-setting engineering leadership. It will pay to consult the A-C office nearest you when planning begins. Or write Allis-Chalmers, Milwaukee 1, Wis., for more information.

CHALMERS A-C ALLIS-CHALMERS

A-4479

Proven On loads *UNDER* 600 Amps....

Fusetron dual-element Fuses Have an Interrupting Rating in Excess of 100,000 Amps.

An interrupting rating in excess of 100,000 amperes for FUSETRON dual-element fuses . . . this was shown by tests that were conducted under conditions that simulated the most severe field conditions. These tests were witnessed and verified by the Electrical Testing Laboratories of New York.

The test circuits were set to deliver far in excess of 100,000 amperes — yet the 250 and 600 volt FUSETRON fuses cleared the shorts without igniting readily flamable material placed around the fuses . . . and there was comparatively little noise.

These tests show that Fusetron fuses, even in the small 30 ampere range, can interrupt safely the most severe available short circuit current.

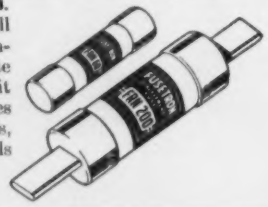
No interference with time-lag

Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses. Even though the interrupting capacity has been greatly increased, the time-current characteristic of Fusetron fuses has in no way been disturbed.

ALL THIS ADDED SAFETY

without changing a panelboard or switch . . . plus 10 point Protection of FUSETRON dual-element FUSES!

1. Protect against short-circuits. **2.** Protect against needless blows caused by harmless overloads. **3.** Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation. **4.** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5.** Protect motors against burnout from overloading. **6.** Protect motors against burnout due to single phasing. **7.** Give double burnout protection to large motors — without extra cost. **8.** Make protection of small motors simple and inexpensive. **9.** Protect against waste of space and money — permit use of proper size switches and panels. **10.** Protect coils, transformers and solenoids against burnout.



Fusetron Fuses Help eliminate needless Shutdowns for Production Engineers.

Work stoppages caused by needless blows are prevented. Even if all the motors on a circuit start at one time or other harmless overloads occur, the fuse link holds to prevent a shutdown.

Likewise, Fusetron fuses guard against needless blows caused by excessive-heating in panelboards and switches—lesser resistance results in cooler operation.

Fusetron Fuses Offer Maximum Safety for Electrical and Safety Engineers.

With an interrupting rating of 100,000 amperes, Fusetron fuses give the greatest possible protection against damage due to short-circuits. And just as important, they reduce the hazard of motor burnouts due to single phasing and overloading.

Fusetron Fuses Save Time and Work for Maintenance Engineers.

Once properly installed, Fusetron fuses require no costly inspection time or down-time for calibration and other maintenance necessary on mechanically operated devices.

Unnecessary repair work on motors is avoided because Fusetron fuses reduce to a minimum the danger of damage due to electrical faults. If trouble occurs, instead of rewinding or replacing burned out motors, simply replace Fusetron fuses.

Switches and panelboards are protected against damage from poor contact heating.

Fusetron fuses also protect against needless blows that cause irritating interruptions of regular maintenance.

Proven On loads *ABOVE* 600 and up to 5,000 Amps.

BUSS Hi-Cap Fuses Have an Interrupting Rating In Excess of 100,000 Amps. . . . *and their blowing time can be coordinated with that of Fusetron fuses.*

An unlimited interrupting rating for BUSS Hi-Cap fuses on any voltage up to 600 . . . this was confirmed by tests reported by the Electrical Testing Laboratories of New York.

BUSS Hi-Cap fuses are designed to give protection against dangerous overloads as well as high fault currents — yet retain the speed of operation necessary to limit heavy short currents to safe values.

When coordinated properly with Fusetron dual-element fuses they will not open ahead of the fuse nearest to the fault — thus the trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of bad fault.

ACTION THAT SAVES YOU MONEY

Don't risk losses. Delay may cost you far more than replacing every fuse with a FUSETRON fuse. By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses on loads up to 600 amperes — and BUSS Hi-Cap fuses on loads above that, you get action that begets money saving.

On New Construction tell your architect to specify this Safer, Better Protection.

Fusetron Fuses Cuts Cost for Top Management.

Cuts maintenance cost — Fusetron fuses are maintenance free.

Cuts motor repair cost — Fusetron fuses guard the motor, against damage due to overloading, single phasing, short circuits and other electrical faults.

Cuts production costs — Shutdowns due to needless blows are eliminated.

Cuts new installation costs — Smaller sizes can be used, therefore big savings can be made on switches and panelboards.

Cuts present installation costs — Fusetron fuses hold and won't open on starting currents so the need for larger panelboards and switches is often eliminated — and in many cases new motors can be added to the circuit without installing larger panelboards or switches.

Play Safe—Install Fusetron Fuses and BUSS Hi-Cap Fuses now!

For blowing time charts or more information on FUSETRON fuses and BUSS Hi-Cap fuses use coupon or write for bulletin FIS and HCS.

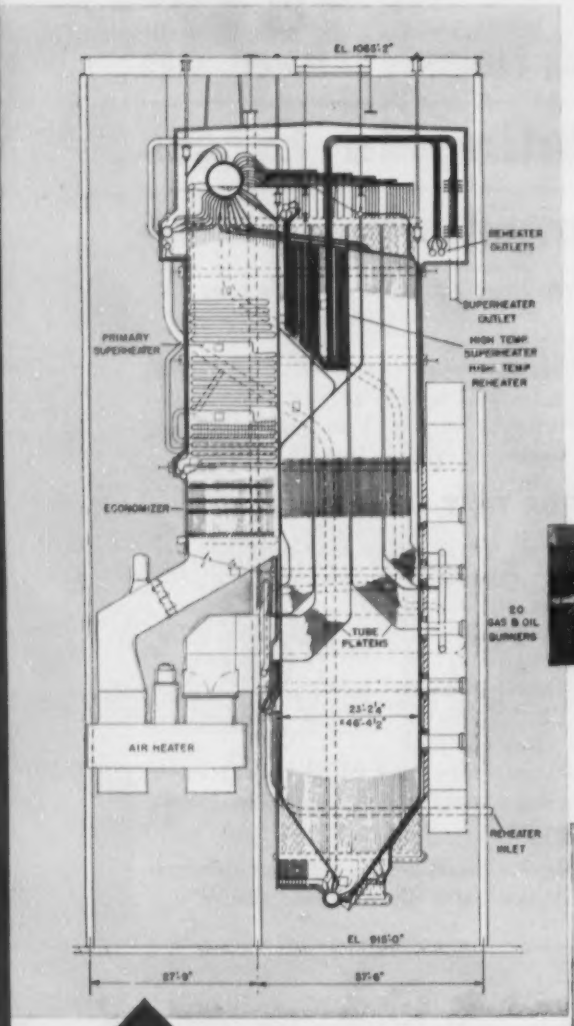
FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

EW-11-54

BUSSMANN Mfg. Co.
(Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.
Please send me complete facts about FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City & Zone*_____ *State*_____

Join the SWING to RILEY

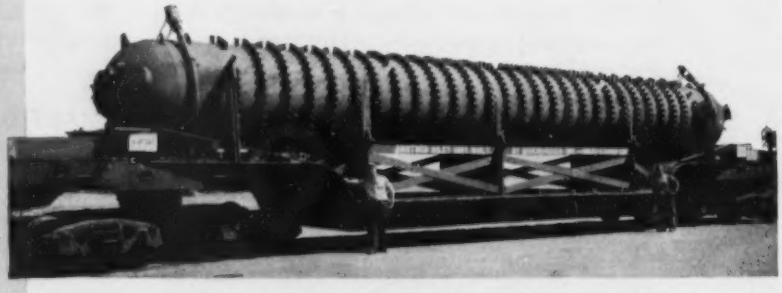


Los Angeles Department of Water & Power—Valley Steam Plant. Two 1,200,000 lbs./hr. 1850 psig. 1000F-1000F reheat. Fired by gas & oil. Riley Single Header Hopper for future conversion to Pulverized Coal. Temperature control by differential firing in divided furnaces.

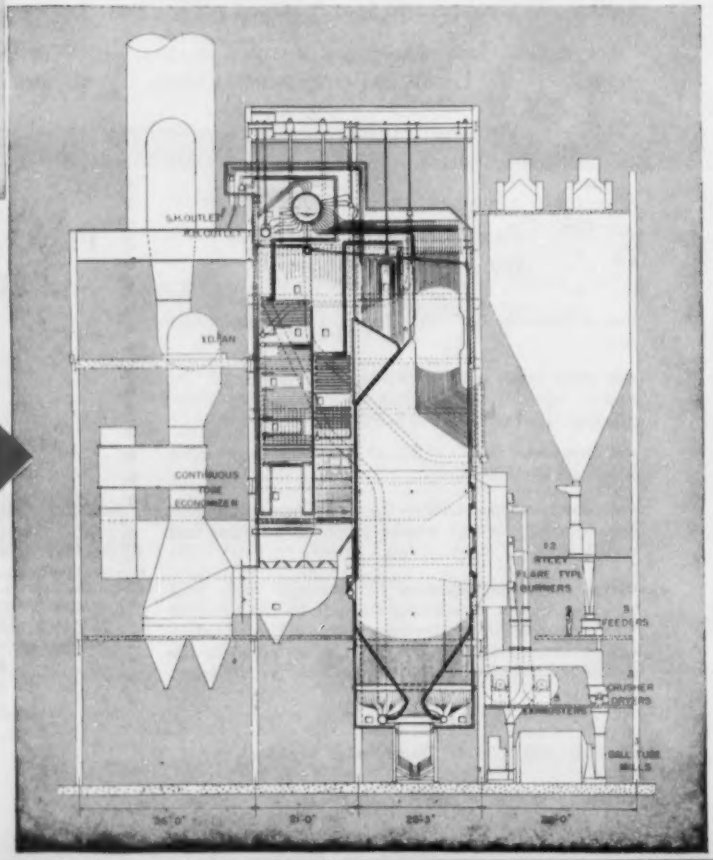
Public Service Co. of Indiana, Inc. Wabash River Station. 805,000 lbs./hr. 2075 psig design, 1005F-1005F reheat. Fired by 12 Riley Flare Type Burners, 3 Riley Pulverizers. Sargent & Lundy, Engineers.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs.

This acceptance of Riley Reheat Units by the public utilities — this marked swing to Riley has been brought about by the outstanding design characteristics of Riley reheat units — low furnace exit temperatures through the use of radiant surface preventing objectionable slag formation; wide load range with stable ignition with damper or combination of damper and spray control; high yearly net efficiency, dependability and continuity of operation.

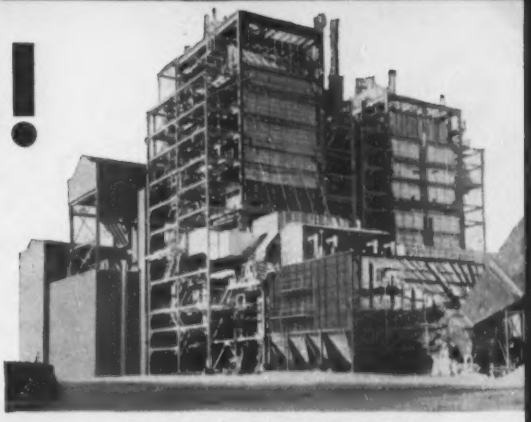


Riley designs, fabricates and erects the complete steam generating unit. Here you see the huge steam drum weighing 127 tons, 60'-0" long, 66" I.D. with 5-3/32" thick steel walls recently fabricated by Riley for one of two Riley reheat units at Los Angeles Water & Power Department's new Valley Steam Plant.

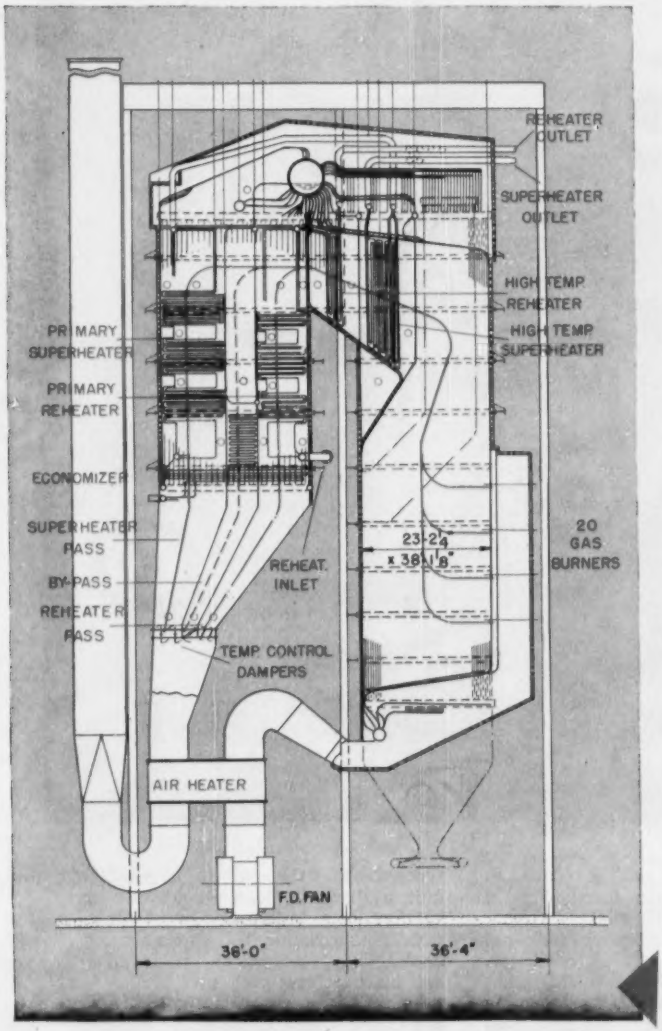


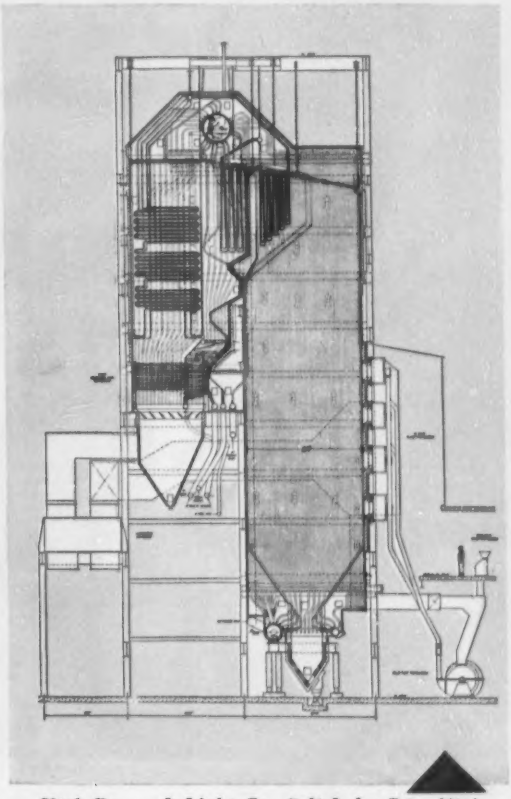
REHEAT UNITS!

a large percentage of all reheat units purchased by public utilities during 1953 were Riley units.



Completely outdoor construction is a feature of the two Riley units at Utah Power & Light Company — Gadsby Station





Utah Power & Light Co., Salt Lake City, Utah
Gadsby Station—575,000 lbs./hr. 1700 psig
1000F-1000F reheat. Riley "50" Pulverizers.
Bechtel Corporation Engineers

Louisiana Power & Light Co.—Nine Mile Point Station
1,000,000 lbs./hr. 1725 psig. 1000F-1000F reheat
Fired by gas & oil. Ebasco Services, Engineers

RILEY *Stoker Corporation*

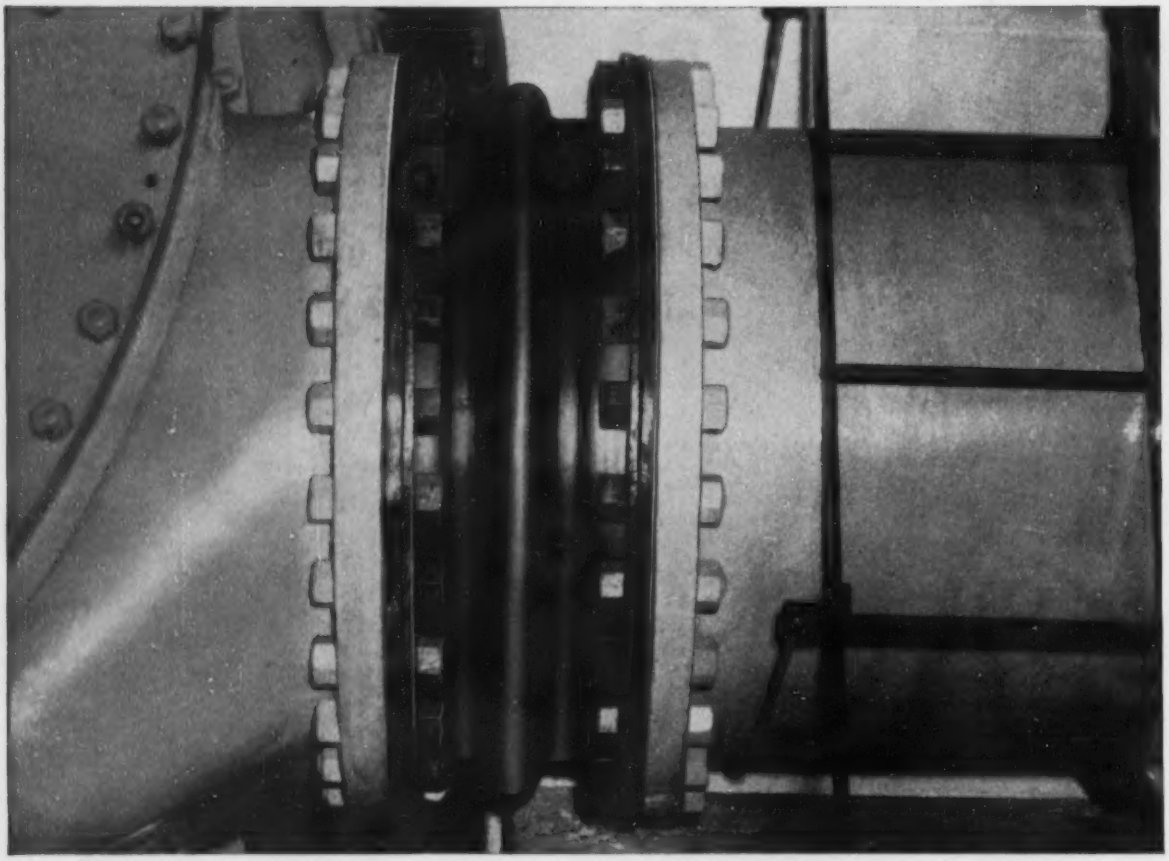
WORCESTER, MASSACHUSETTS

Boston New York Philadelphia Buffalo Washington Pittsburgh Cleveland Detroit Chicago Cincinnati Charlotte New Orleans
Atlanta St. Louis Kansas City St. Paul Tulsa Houston Denver Salt Lake City Los Angeles San Francisco Portland Seattle

COMPLETE STEAM GENERATING UNITS

AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITIES, INDUSTRIAL POWER AND HEATING PLANTS

28 years old... but there's a lot of life in the old joint!



Back in 1926, this 30" x 12" U.S. Expansion Joint was installed in a Louisiana power plant. This rubber joint is still in fine working condition. Age has not impaired its efficiency. Three other U.S. Joints in this plant are the same age, are still performing well... and one of them has been used continuously in the valve end inlet header water circulation line in a *very moist location.* Our service engineers report it has many more years of fine service still ahead!

In United States Rubber Company's Expansion Joint Line are standard types to meet the majority of general industrial requirements on pressure or vacuum lines—insulating against vibration, compensating for expansion or contraction. Joints can also be designed and built to meet your own specifications. You can always rely on U.S. Expansion Joints to lengthen the life of equipment, save many times their original cost.

Get in touch with any of United States Rubber Company's 25 strategically located District Sales Offices, each staffed with engineers to serve you, or write to address below.

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"U.S." Research perfects it
"U.S." Production builds it
U.S. Industry depends on it

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

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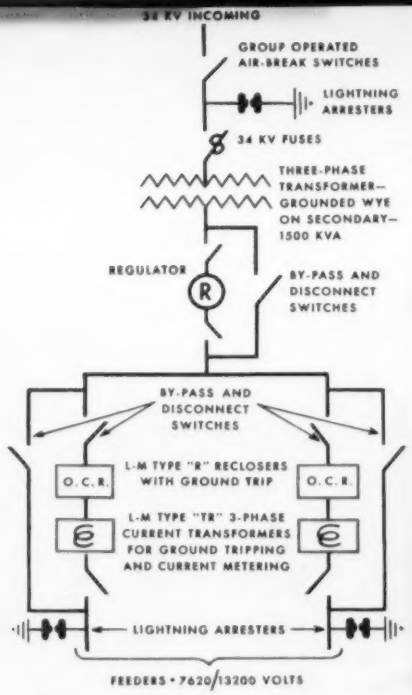
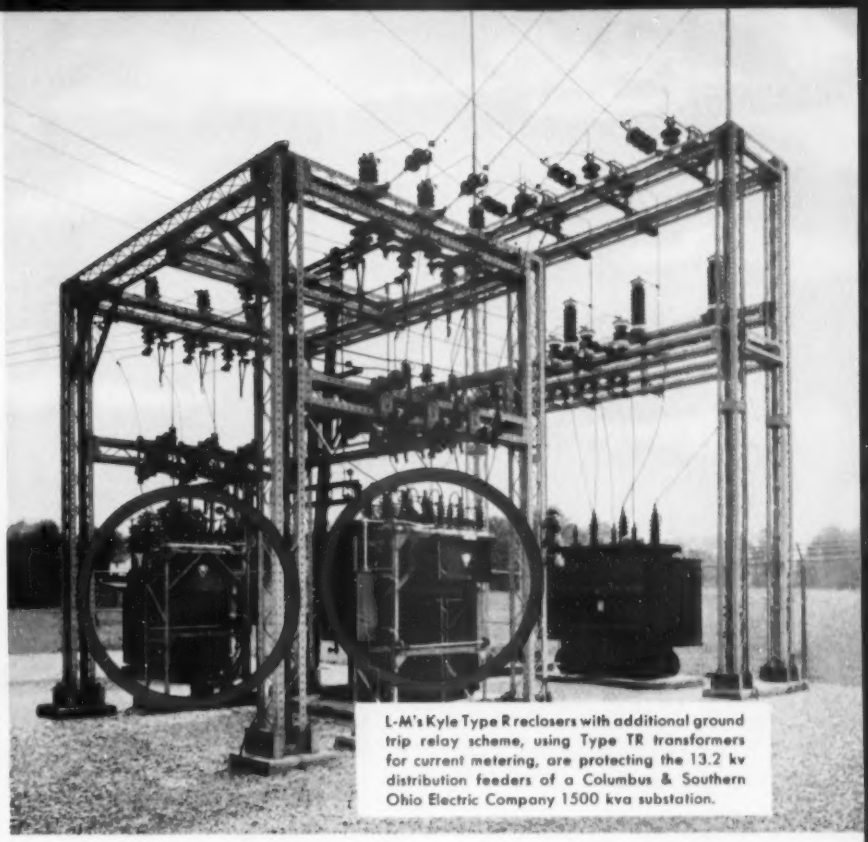


One line diagram of the substation at right. This 34 kv to 13.2 kv substation has a bus regulator and two 100 amp. Kyle Type R heavy-duty reclosers, assuring quality and continuity of service to the customer at all times.



L-M's Kyle Type R reclosers with additional ground trip relay scheme, using Type TR transformers for current metering, are protecting the 13.2 kv distribution feeders of a Columbus & Southern Ohio Electric Company 1500 kva substation.

Take Advantage of Additional Protective Schemes . . .

New Control Devices Now Available with Kyle Type R 3-Phase Reclosers

Methods are given for obtaining auxiliary protective schemes used to supplement the normal series over-current tripping of the recloser.

By **R. C. KIRK**
Manager
Kyle Products Sales
Line Material Company

Electric service continuity is essential today, as customers depend more and more on electricity for operation. Utility engineers as well as Line Material engineers are aware of the problems involved in designing and operating a protected system economically.

To meet this challenge, L-M engineers have developed a heavy-duty recloser that provides simultaneous tripping of all three phases on feeders with heavy loads and high fault currents. This recloser provides series tripping, reclosing, and dual timing to permit coordination with fuses; and offers facilities to adapt almost any auxiliary relays and indicating equipment to it. Thus it provides the best protective scheme for your system.

Applications for the Type R

The Kyle Type R recloser is a self-contained unit that can be installed on a line pole as well as in a substation. It is a rugged, power-class recloser designed to replace breakers in substations with up to 100,000 kva fault capacity. In addition to segregating permanent faults from the system, the Type R recloser is capable of clearing faults of a transient nature much faster than is normally accomplished with station breakers.

Type R reclosers are also installed on the feeders outside substations that have slow breaker operations, providing for fast (2-cycle, maximum) fault clearing time. This effectively and economically improves operation, provides transient fault protection for the distribution system, relieves the duty on the station breakers, reduces the number of service calls, and greatly enhances service continuity.

Almost any supplementary relaying scheme is adaptable to the Type R recloser operation:

Ground Trip Solenoid is a self-contained ground relay possessing its own dual time-current characteristics.

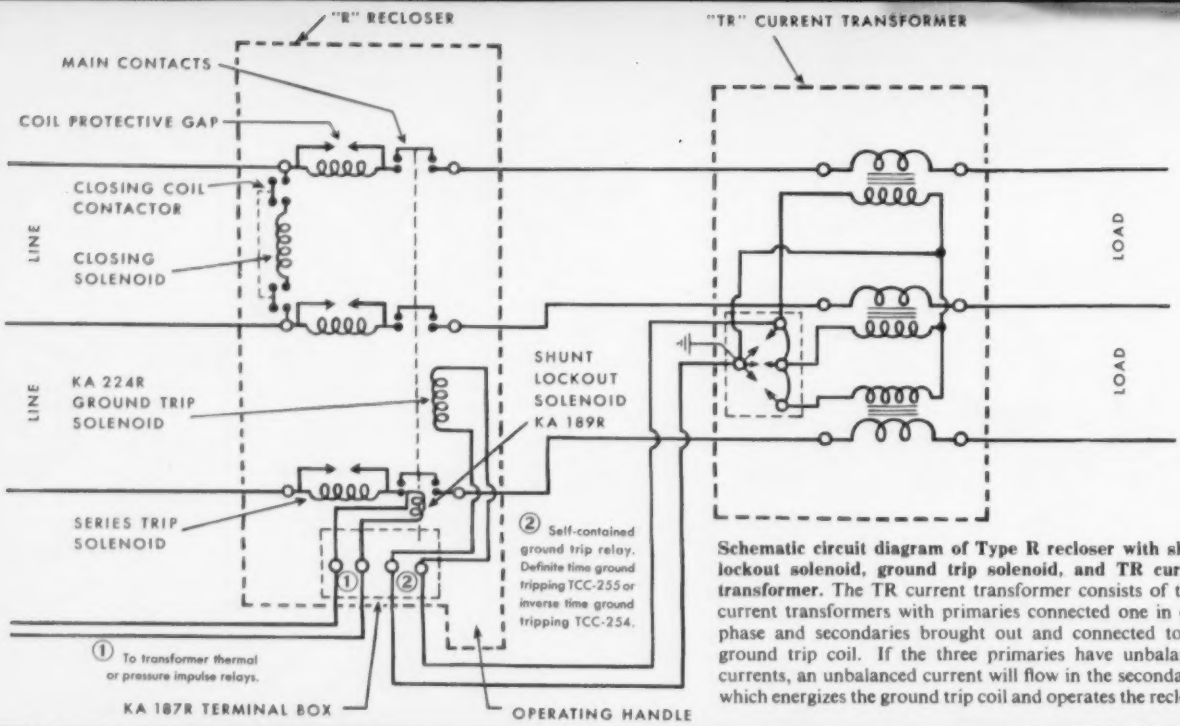
Shunt Trip Solenoid is a tripping device only, designed to operate the recloser when energized from a supplementary relay scheme.

Shunt Lockout Solenoid is a lockout device only; locks out the recloser instantly. Like the shunt trip solenoid, it is energized by remote control.

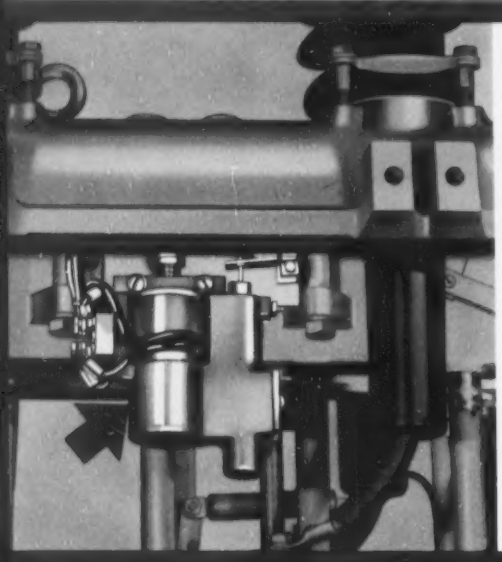
Auxiliary Switch provides positions for remote-control indication or low-voltage-control switching of apparatus used in conjunction with the Type R recloser.

See Protective Schemes on Next Three Pages ▶

LINE MATERIAL Kyle® Reclosers



Schematic circuit diagram of Type R recloser with shunt lockout solenoid, ground trip solenoid, and TR current transformer. The TR current transformer consists of three current transformers with primaries connected one in each phase and secondaries brought out and connected to the ground trip coil. If the three primaries have unbalanced currents, an unbalanced current will flow in the secondaries, which energizes the ground trip coil and operates the recloser.

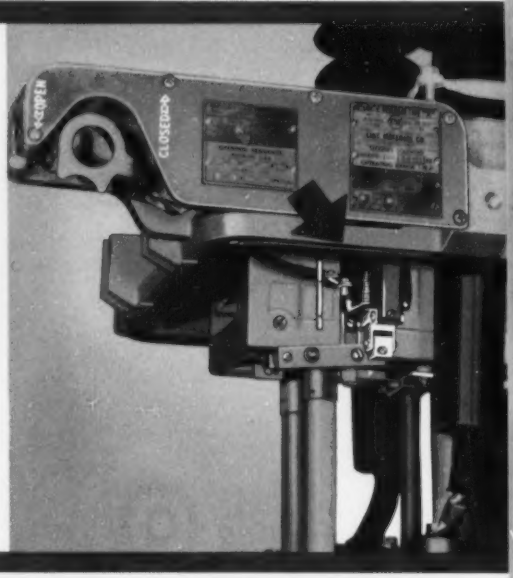


Ground Trip Solenoid

is a self-contained relay possessing its own dual time-current characteristics. It is energized by an unbalanced current from paralleled secondaries of three current transformers. Total operations to lockout and reclosing time remain the same as in series tripping.

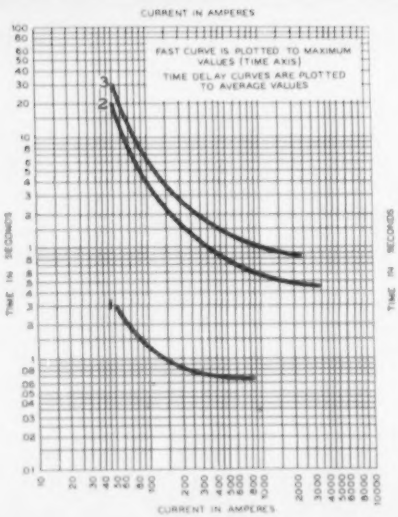
Shunt Lockout Solenoid

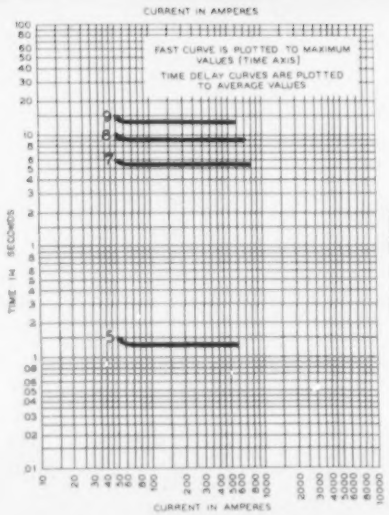
is a lockout device only, operated by remote control. When energized, this solenoid acts upon the recloser lockout mechanism to open the main contacts and lock out the closing coil switch to prevent reclosing. Maximum clearing time of the Type R, following energizing of the shunt lockout solenoid, is 7 cycles.



Time Current Curves

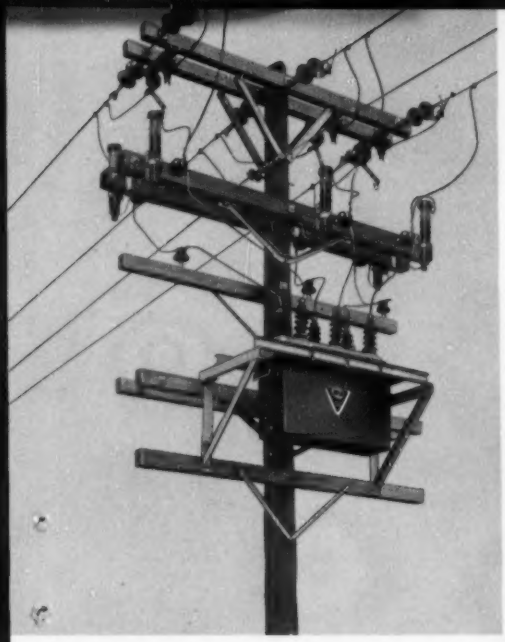
Inverse Time Ground Tripping TCC-254. Note: Horizontal ordinate may be reindexed for other minimum trip settings (67, 100, 133, 200, and 400 amps.).


CURRENT IN AMPERES
FAST CURVE IS PLOTTED TO MAXIMUM VALUES (TIME AXIS)
TIME DELAY CURVES ARE PLOTTED TO AVERAGE VALUES
TIME IN SECONDS
CURRENT IN AMPERES

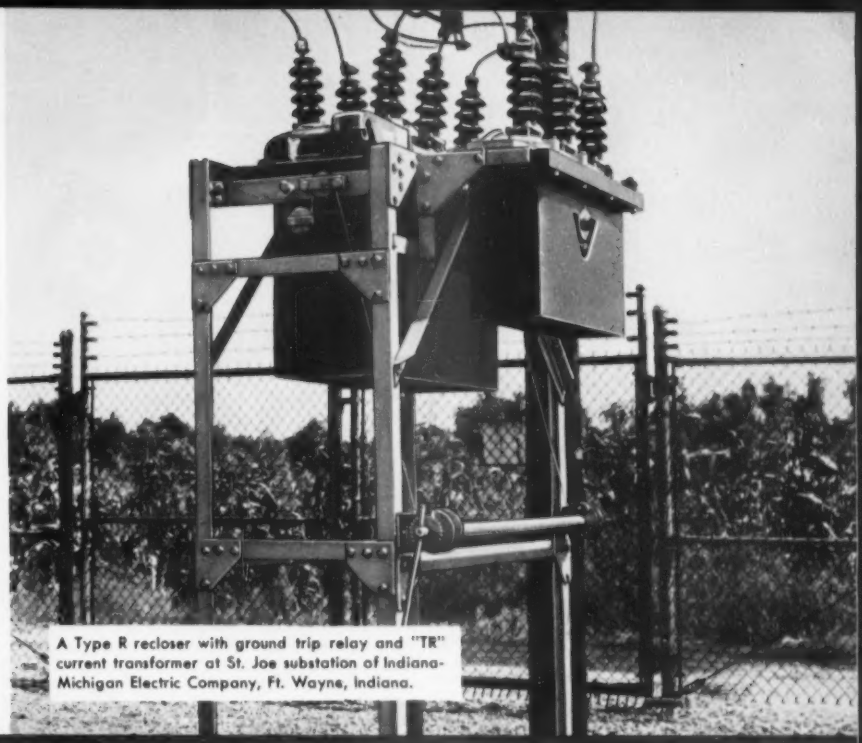

CURRENT IN AMPERES
FAST CURVE IS PLOTTED TO MAXIMUM VALUES (TIME AXIS)
TIME DELAY CURVES ARE PLOTTED TO AVERAGE VALUES
TIME IN SECONDS
CURRENT IN AMPERES

Time Current Curves

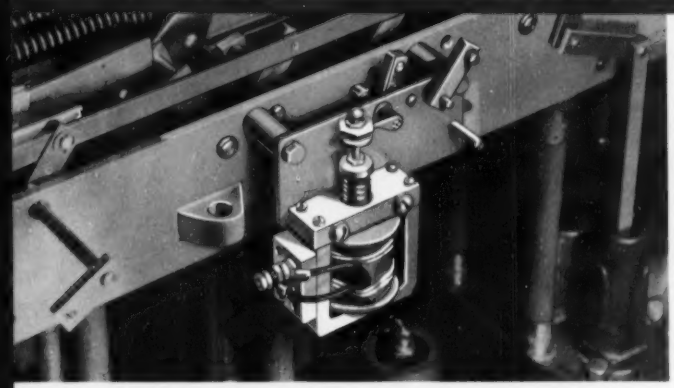
Definite Time Ground Tripping TCC-255. Note: Horizontal ordinate may be reindexed for other minimum trip settings (67, 100, 133, 200, and 400 amps.).



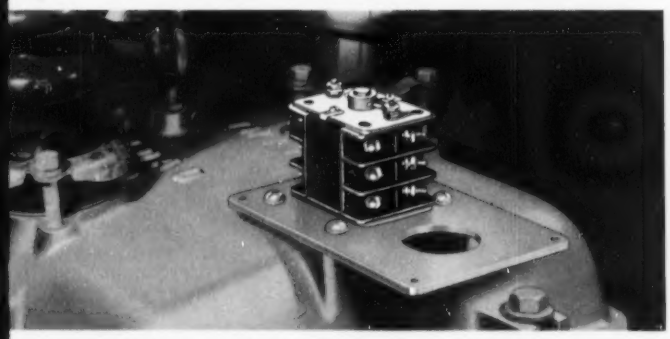
A pole-mounted Type R recloser protecting 7.2/12.47Y kv distribution feeder of a southwestern power company.



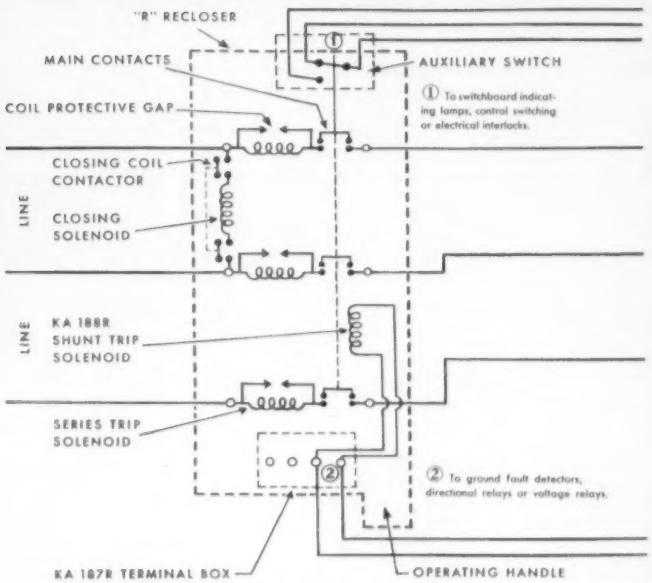
A Type R recloser with ground trip relay and "TR" current transformer at St. Joe substation of Indiana-Michigan Electric Company, Ft. Wayne, Indiana.



Shunt Trip Solenoid is a tripping device only, possessing no time-current characteristics and no intended time-delay. It is designed to operate the recloser when energized by relay or control systems established by the utility engineers to supplement series tripping. Total operations to lockout and reclosing time remain the same as in series tripping. Unlike series or ground tripping, the shunt trip may be energized from a source not affected by recloser operation. The shunt trip may be used in place of, and interchangeably with, the ground trip solenoid. Clearing time is 4 cycles, maximum, plus relay time.



Auxiliary Switch may be a one-, two-, or three-stage unit, used for remote-position indicating or low-voltage-control switching of apparatus used in conjunction with the Type R recloser. Up to six sets of contacts in any combination of positions can be provided.



Schematic circuit diagram of Type R recloser with shunt trip solenoid and auxiliary switch.

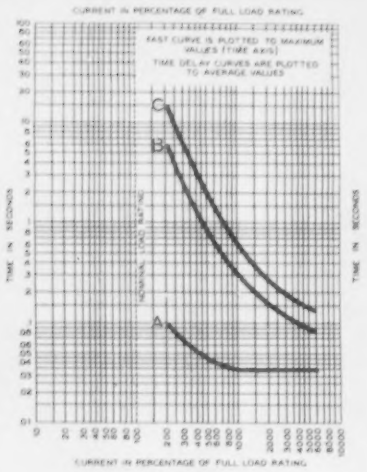
The shunt trip solenoid operates the recloser when energized by auxiliary relay schemes. Applications for the Type R recloser include replacing outmoded substation circuit breakers. At times it is desirable to retain the existing relay schemes. This can be accomplished by using the shunt trip solenoid to operate the recloser.

The auxiliary switch is connected by a mechanical linkage to the recloser contact operating mechanism. There are two sets of contacts per stage that can be set for "A" closed when the main contacts are closed, or "B" open when the main contacts are closed. Up to six sets of contacts in any combination of "A" or "B" can be provided to operate auxiliary equipments when the recloser operates.

LINE MATERIAL
Kyle® Reclosers

Continued ▶

Time-Current Curves
Phase Tripping TCC-253


CURRENT IN PERCENTAGE OF FULL LOAD RATING
FAST CURVE IS PLOTTED TO MAXIMUM VALUES (TIME AXIS)
TIME DELAY CURVES ARE PLOTTED TO AVERAGE VALUES
C
B
A
NOMINAL LOAD RATING
TIME IN SECONDS
TIME IN SECONDS
CURRENT IN PERCENTAGE OF FULL LOAD RATING

Overcurrent Protection

The series trip solenoid activates overcurrent tripping of the unit. It has a selection of three time-current characteristics: Fast (A), Retarded (B), and Extra-retarded (C), with four operations to lockout in any of seven sequences. The series tripping mechanism of each phase operates its own time-delay unit. Where the fault is 3-phase, phase-to-phase, or phase-to-ground, it will not affect the timing of the recloser. With this time-delay arrangement, the time for clearing multi-phase faults is determined by the largest current.

A Type R recloser display truck is available for demonstrating to members of your organization the construction, operation, and application of L-M's Kyle Type R recloser.

Get the Whole Story on Type R Reclosers

Ask your L-M Field Engineer to schedule a demonstration for you and to furnish you with copies of Bulletin CR1C on the heavy-duty Type R recloser. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

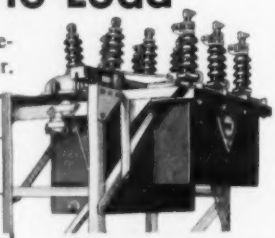
Complete Coordinated Automatic Protection from Substation to Load

Only L-M offers the fully coordinated series of single-phase and 3-phase reclosers that permits complete automatic protection from substation to user.

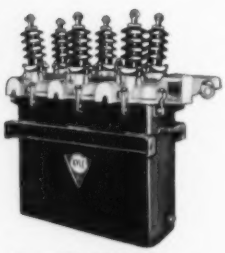
Complete Coordinated Automatic Protection from Substation to Load

Distribution Class Nominal Rating 14.4 kv BIL 95 kv			Intermediate Duty Nominal Rating 23 kv BIL 150 kv				Heavy Duty Nominal Rating 14.4 kv BIL 110 kv			
Single-Phase Type H Three-Phase Type 3H			Single-Phase Type E Three-Phase‡				Single-Phase Type L Three-Phase Type R			
Rating Amps.	Min. Trip Amps.	Inter. Rating* 14.4 kv	Rating Amps.	Min. Trip Amps.	Inter. Ratings* RMS Amperes 14.4 kv	23 kv	Rating Amps.	Min. Trip Amps.	Inter. Ratings* RMS Amperes 4.8 kv	14.4 kv
5	10	125	5	10	200	125	.....	.....	.....	.....
10	20	250	10	20	400	250	.....	.....	.....	.....
15	30	375	15	30	600	375	.....	.....	.....	.....
25	50	625	25	50	1000	625	25	50	1500	1500
35	70	875	35	70	1400	875	35	70	2100	2100
50	100	1250	50	100	2000	1250	50	100	3000	3000
			70	140	2500	1750	70	140	4200	4000
			100	200	2500	1750	100	200	6000	4000
							140	280	6000	4000
							160†	320	6000	4000
							185†	370	6000	4000
							200β	400	6000	4000
							225†	450	6000	4000
							280†	560	6000	4000

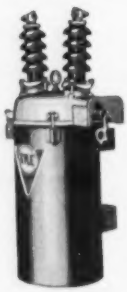
*Recloser interrupting ratings are based on a maximum test circuit X/R ratio of 8 and the asymmetrical rating in total RMS amperes is 1.4 times the symmetrical rating given in the table.
†Available in 3-phase Type R only.
βAvailable in single-phase Type L only.
‡Electrical interconnection available to give 3-phase lockout.



Type R, 3-Phase 280 Amperes—up to 6000 amperes interrupting capacity at 4.8 kv, 4000 amperes at 14.4 kv. Available with ground trip solenoid and other accessories, making it the most versatile recloser available.



Type 3H, 50 Amperes—3-phase protection up to 1250 amperes interrupting capacity at 14.4 kv. Available with shunt lockout coil for remote electrical lockout.



Type L, 200 Amperes—heavy-duty single-phase protection up to 6000 amperes at 4.8 kv, 4000 at 14.4 kv.

Type E, Single-Phase 100 Amperes—intermediate duty, 23 kv; interrupts up to 2500 amperes at 14.4 kv, 1750 amperes at 23 kv. Available with electrical interlock for 3-phase lockout.

Type H, Single-Phase 50 Amperes—interrupting capacity up to 1250 amperes at 14.4 kv.

LINE MATERIAL
Kyle® Reclosers

And Now...

RCA Announces the FIRST Low-Cost Packaged Microwave with Voice Channels

PROVED throughout the nation and the world, RCA 960 megacycle Microwave is now available in a low-cost "package" unit, MM-9, as a complete station.

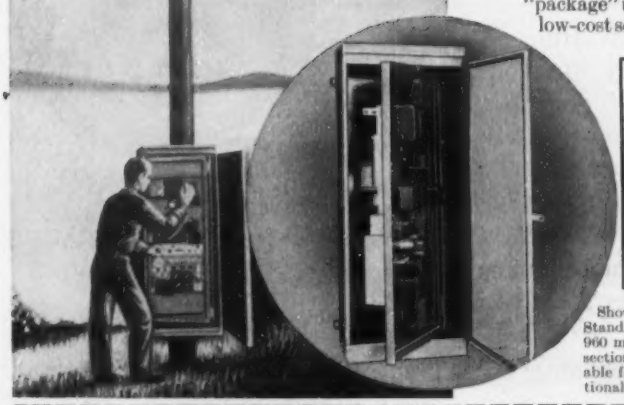
Important savings include:

- **Minimum real estate requirements**
- **No tower construction**
- **Easy economical installation**
- **Minimum maintenance**
- **Unattended reliable operation**

When mounted on inexpensive supports, such as wooden poles, up to 100 feet high, or on existing structures, which can be spaced 20 or more miles apart, the MM-9 Microwave "package" units provide an ideal low-cost solution to many point-to-point communications problems.

RCA Microwave uses highly directional radio signals which are beamed from one relay station to the next by "dish" antennas. It can be interconnected with existing telephone lines and switchboards and virtually eliminates the weather hazards of carrier and wire lines. RCA Microwave employs readily available tubes and familiar circuits which are easy to service. The RCA Service Company provides nationwide installation and service facilities, if desired.

For complete information on the new MM-9 Packaged Microwave Stations, send coupon, below.



Showing hinged rack construction, with all components easily accessible for servicing. Standard "package" equipment includes weather-proof cabinet, 2 parabolic reflectors, 960 megacycle transmitter unit, exciter unit, 960 megacycle receiver. Also 2 100-ft. sections of semi-flexible transmission lines with all required fittings. Space is available for multiplex equipment to provide two voice channels with signaling. Additional multiplex equipment can be mounted in a similar cabinet.

Typical Uses of MM-9 Packaged Microwave:

1. Telephone Circuits
2. Supervisory Control
3. Remote VHF Control
4. Facsimile
5. Teletype

FOR

- Gas Utilities
- Electric Utilities
- Pipelines
- State Agencies
- Municipal Systems
- Police Departments
- Transportation Systems

RCA

RADIO CORPORATION of AMERICA

COMMUNICATIONS EQUIPMENT

CAMDEN, N. J.

Radio Corporation of America, Camden, N. J.
Dept. K-45, Building 15-1
In Canada, RCA VICTOR Company Limited, Montreal
Please send me your new booklet, "RCA Low-Cost Packaged Microwave Stations."

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

☐ *Have an RCA representative get in touch with me.*

even in
an age of speed...
sheer velocity is not
always an asset...

...in fact
there are some
instances...

...where it's
a real
liability!

take low disc speed in a meter . . .

Speed is definitely not an asset in the turning rate of a watt-hour meter disk.

That's why the disk in the Sangamo J2 Watthour Meter revolves at a low, low rate of speed—only 10 revolutions per minute at the nameplate rating of 15 amperes. And only 66⅔ revolutions per minute or approximately one revolution a second when the J2 is busy measuring a full load of 100 amperes. Yet the J2 has exceptionally high driving power.

This means the Sangamo J2 lasts longer and requires less maintenance than ordinary meters . . . there's less wear on all moving parts.

It means good public relations, too. Mr. Customer doesn't like to see his meter spin.

A METER WITH STRAIGHT LINE ACCURACY

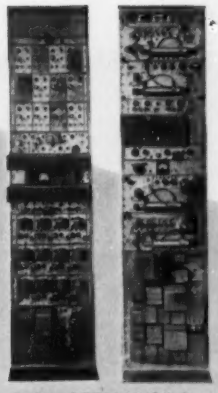
UP TO 100 AMPERES

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

JM54-10

The **ONLY** Microwave system with all equipment made under **ONE** roof...

Federal PTM MICROWAVE



Federal PTM Multiplex and RF Equipment

—including associated telephone, carrier and VHF mobile radio equipment ... engineered by communication specialists!

HERE'S THE ANSWER TO DEPENDABLE SERVICE

over all voice and signal facilities!

"Made under one roof!" That's the outstanding over-all advantage of Federal Pulse-Time Modulation Microwave... the system backed by 23 years of world-wide experience!

Federal PTM Microwave — *plus* Federal Telephone, Carrier and VHF Mobile Radio—eliminates "shopping" the equipment market . . . assures *uniformity* of circuit quality . . . provides complete, integrated, coordinated voice and signal facilities . . . all engineered by microwave pioneers and communication specialists.

Here's the answer to efficient, dependable, system-wide service . . . in all weather . . . over any terrain!

Here is *streamlined* microwave...*simpler* equipment requiring *fewer* tubes . . . simplest, smallest, highest-output RF equipment—all easy to maintain.

Over 6,000 route-miles installed in the U. S. are gilt-edged proof of PTM's *one-manufacturer* superiority.

Whatever your communication needs, Federal is ready to help you plan microwave links and networks of any length and channel capacity... to deliver a "turn-key" installation from a single reliable source of supply!

"MICROWAVE AT ITS BEST" for: Pipelines, Utilities, Railroads, Telephone, Highways, Airports, others.

Telephone

Carrier

Mobile

For full information on Federal PTM Microwave, write to Dept. H-517

Federal Telephone and Radio Company

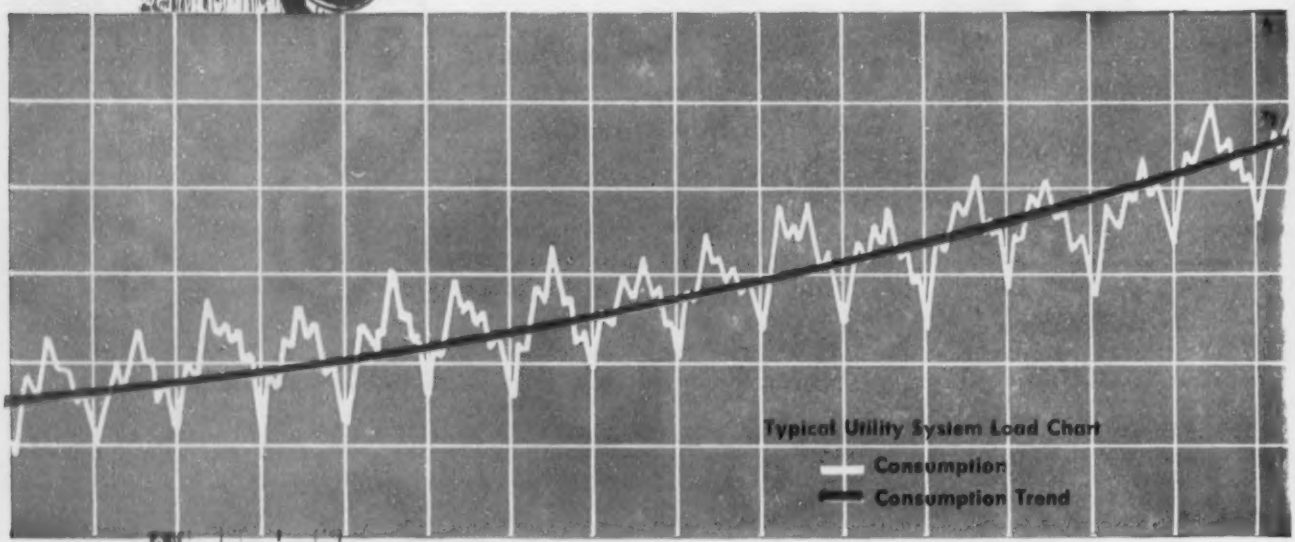
A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

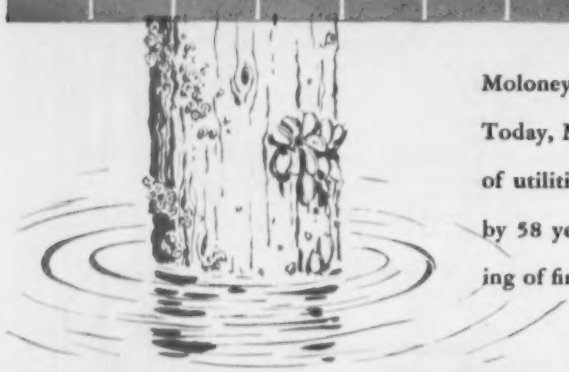
PTM AND WIRE TRANSMISSION SALES 100 KINGSLAND ROAD CLIFTON, N. J.

In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

R E L E N T L E S S

Just as regular and relentless as the tide is the ebb and flow of the utility load as determined by the demands of its customers. This is as it should be except that everywhere you turn there are more customers . . . hence more demand.





Moloney has expanded its facilities to keep pace with the industry. Today, Moloney stands ready, as it always has, to meet the needs of utilities with the most modern and adequate facilities backed by 58 years of experience devoted exclusively to the manufacturing of fine transformers.

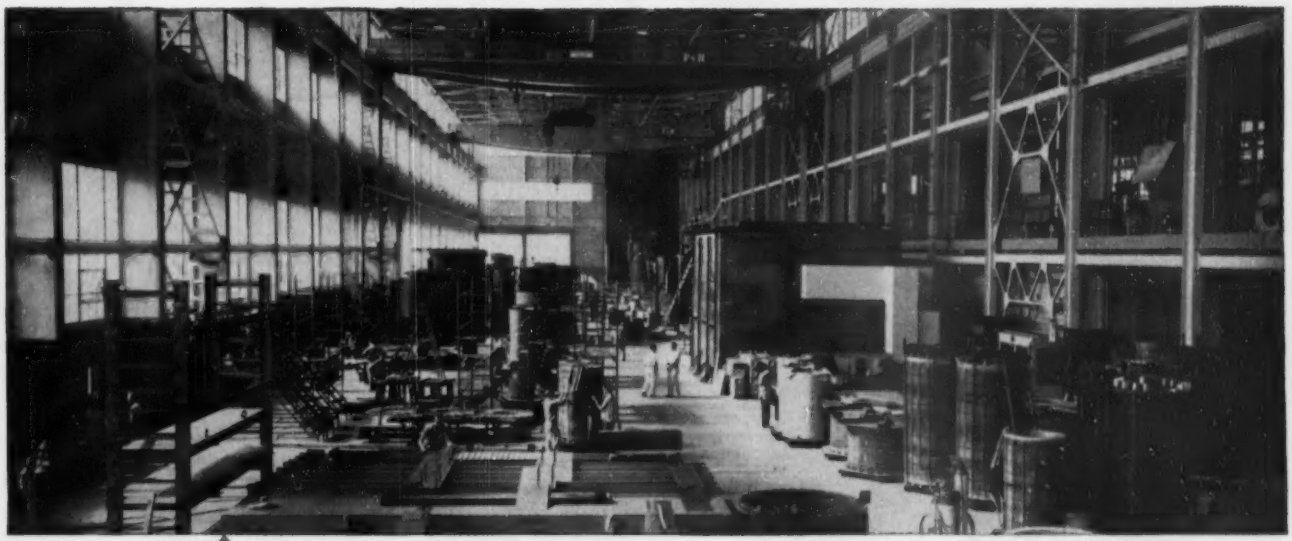
ME54-40

M O L O N E Y

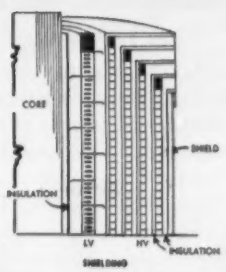
Power Transformers • Distribution Transformers
Load Center Transformers • Unit Substations • Network

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT

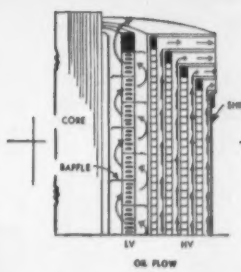
AS THE TIDE . . .



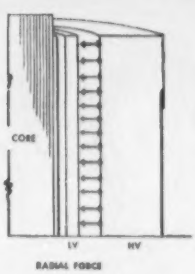
Moloney, in planning the expansion of its facilities for the manufacture of large Kva power transformers, included equipment for the fabrication of concentric layer high voltage windings. Concentric layer high voltage windings possess these inherent qualities.



Shields are placed on the outside of the high voltage coils. Insulation is placed between winding and between layers. The proximity of insulation within the winding provide superior dielectric strength.



High voltage concentric layer windings have axial ducts which permit unrestricted oil flow past each conductor. Oil flow is therefore directed through the winding itself to provide the most efficient heat transfer.



Since high voltage windings are wound about the same axis as the transformer low voltage windings, all mechanical forces are radial.

ELECTRIC COMPANY

Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers
Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

BITUMINOUS COALS FOR EVERY PURPOSE

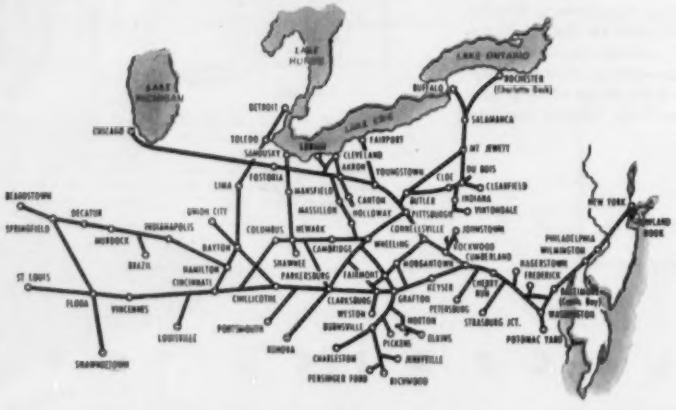
Whatever your fuel needs, we have a coal that is

Just the Ticket!

• In fact, you can write *your own* ticket—for the vast Bituminous fields served by the Baltimore & Ohio contain excellent coals *in wide variety*. For centuries to come, these coals will be available—a dependable source of low-cost heat and energy.

Modern mechanization at the mines assures low costs as well as uniform size and quality. The location of the fields—close to industry's front door—contributes to low transportation expense. Storage is economical because costly facilities are not required. And with the help of new combustion methods and equipment, Bituminous offers its users an increased burning potential.

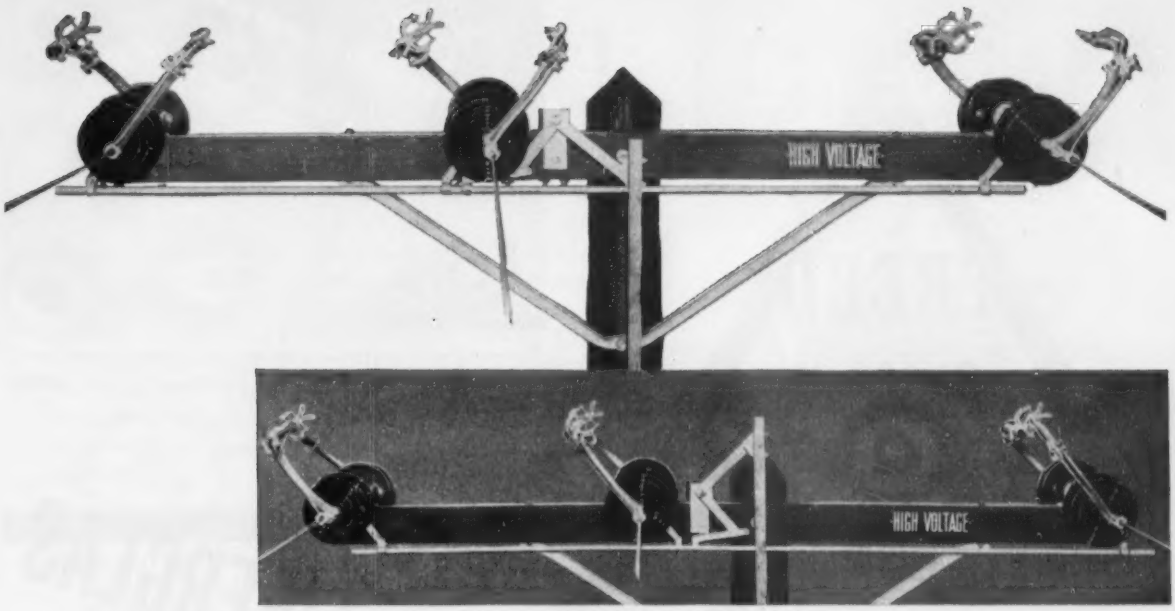
ASK OUR MAN! He can give you worthwhile advice as to supply sources and burning methods for the particular coal you need. The efficiency, economy, and cleanliness of B&O Bituminous today will be a revelation!



LINKING 13 GREAT STATES WITH THE NATION

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!



Note clean, neat pole top appearance of KPF switches open (top picture) and closed. Appearance is marked contrast with usual clutter of mechanism.

Simple design and sturdy construction insure years of trouble-free switching

KPF Air Break Switches look different because they *are* different. They are the simplest air break switches made. They consist of two rigid dead-end insulator assemblies with rigid jumpers forming the switch arms. One assembly is mounted stationary to the cross-arm. The other rotates to make and break the circuit. There are no complex parts to get out of order, require lubrication, adjustment or other service. Sturdy KPF switches serve indefinitely.

Simple design also means simpler manufacturing and lower cost. No separate dead-ends or extra insulators are required.

Finally, installation normally requires less than half the normal time. Phase units are shipped ready for use and need only be bolted to the cross-arm.

KPF Air Break Switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies.

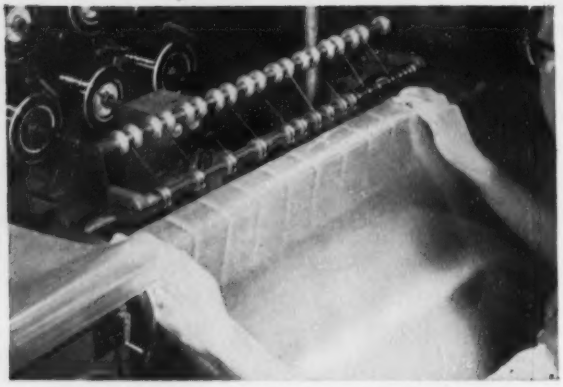
For the world's simplest, surest, lowest cost air break switch, specify KPF Air Break Switches—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY
1624 East Alpine Avenue, Dept. E, Stockton 5, California

28266

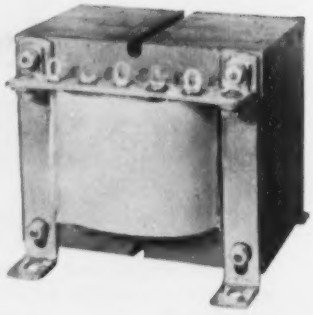
KPF
AIR BREAK SWITCHES
Standard for nearly half a century



Operator of a Universal winding machine using Natvar Silicone-Coated Fiberglas for interwinding and layer insulation of a Freed multiple wound class H transformer.

FREED CLASS H TRANSFORMERS

are insulated with NATVAR Silicone-Coated FIBERGLAS



In spite of its weight, only 25 lbs., this class H unit delivers 2 kva. A unit of the same size with class A insulation would have an output of only 0.5 kva. Interwinding, interlayer and outside wrapper are of Natvar Silicone-Coated Fiberglas for maximum reliability.

FREED TRANSFORMER COMPANY, pioneer in the field of radio and electronics, designs and manufactures test instruments, transformers, reactors and filters of high reliability, including an extensive line of components built to meet MIL-T-27.

One of the significant developments in military apparatus is the saving of space and weight through use of new materials which permit operation at higher temperatures with no sacrifice of reliability. For these applications, Class H insulation must be used.

Freed uses Natvar Silicone-Coated Fiberglas to insulate Class H transformers because of its consistently good electrical and physical properties. All Natvar flexible insulations are dependably uniform, no matter when or where purchased. They are available either from your wholesaler's stock or direct from our own.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE RAHWAY 7-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Abeglas®
- Varnished-lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 22

THE NEW DUNCAN SINGLEPHASE METER

TYPE MK*

TYPE MK-S

TYPE MK-A

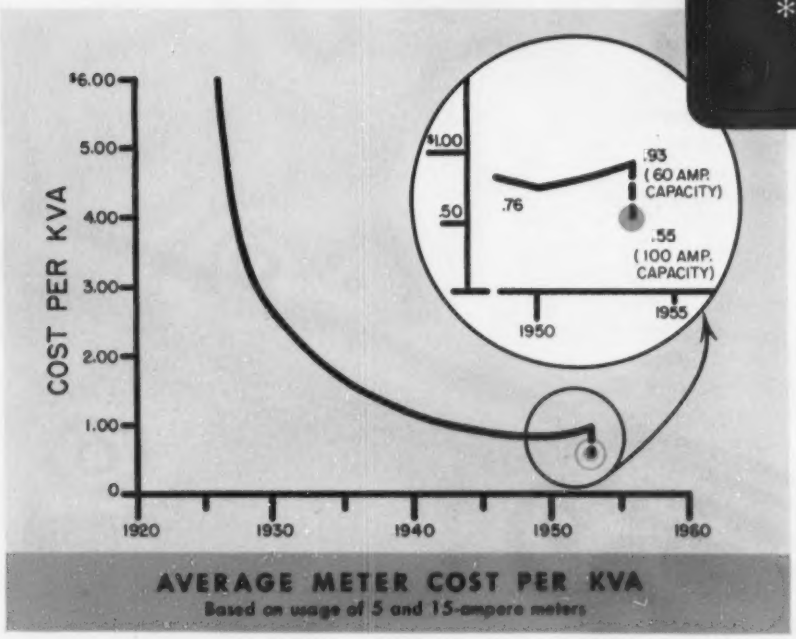
The Duncan Type MK singlephase watthour meter is a completely new design with increased capacity to keep ahead of the expanding use of electric energy. The general purpose service Type MK meter, although nominally rated at 15 amperes, has "extended range" capacity to accurately meter continuous loads to 100 amperes. This has been done with no sacrifice of performance at lighter loads.

The MK Gives You:

- **CAPACITY** — "Extended range" load characteristic *plus* adequate thermal capacity — metering of services to 100 amperes.
- **COORDINATED INSULATION** — Coils molded in polyvinyl chloride — protective gaps flash over at 4,500 volts r.m.s. — approximately one-half of the insulation level.
- **CONTINUING DUNCAN FEATURES** — Adjustments accessible from front . . . No adjustments of worm wheel mesh or bearings necessary . . . Alnico damping magnet . . . Time proven bearings . . . Convenient register re-set.

DUNCAN ELECTRIC MFG. CO.
LAFAYETTE **INDIANA**

Pioneers in Extended Range Metering



AVERAGE METER COST PER KVA
Based on usage of 5 and 15-ampere meters

** MK Means More Kva*

for

LOWER COST METERING

speeds
Crimpit
connections

Makes every overhead distribution connection up to 1/0 ACSR combinations!

MD3 HYTOOL

Only 24 inches long. Weighs **8 pounds**—delivers **9000 pounds** crimping force at a single stroke. Compound cam-and-toggle action delivers great force at start of stroke when requirement is greatest—with plenty of follow-through for smooth completion of connection, even on tap combinations involving sizes as large as #2 copper or 1/0 ACSR. Lightweight HYTOOL's four crimping grooves will install *every* connector in the CRIMPIT program—quickly and easily.

The Burndy CRIMPIT program is rapidly being adopted by leading utilities as the most practical and efficient method of making uniform, economical overhead connections. To implement the program, Burndy introduces this brand-new, inexpensive MD3 HYTOOL, a universal hand tool designed for *easy* lineman use.

Two special bulletins detail the engineering principles behind this new tool and the entire CRIMPIT program. Your Burndy representative will be glad to send you both—or write direct to BURNDY—Norwalk, Connect.; Toronto, Canada.

Factories: New York, California, Toronto.
Export: Philips Export Company.

It's good business to connect with

BURNDY

54-26

...FIRST name in electrical connectors; tools; methods

• Elkonite contacts offer designers of heavy-duty circuit interrupting equipment combined characteristics of:

Good electrical and thermal conductivity

Resistance to arc erosion

Resistance to sticking

Resistance to mechanical wear and impact

High hardness . . .

to a degree unequalled by other materials.

These qualities spell long, dependable contact life. They are achieved by the unique Elkonite process, developed by Mallory, which combines metals that will not alloy. New materials result, with physical properties often superior to those of their constituents.

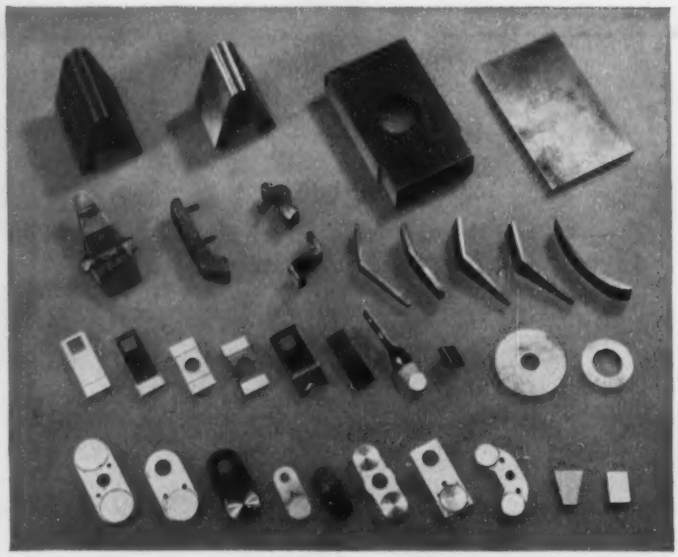
Thus, Elkonite combines the arc-resistance of refractory metals, such as tungsten, molybdenum or their carbides, with the high current-carrying ability of silver or copper. Elkonite contacts withstand severe short-circuit arcing conditions, and are the accepted standard for all heavy-duty circuit-interrupting equipment.

Only Elkonite offers *all* the characteristics you require for maximum performance in your product. An extensive selection of types is available to suit your specific requirements. For detailed technical information and valuable design data, write today for a copy of the new Mallory Contact Catalog.

For Heavy-Duty Service

ELKONITE® Contacts

Have No Equal



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Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
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P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc. INDIANAPOLIS 6, INDIANA

BEFORE YOU BREAK GROUND

Construction of a new plant starts when the steam shovel takes its first bite of earth. But the actual building process begins *before* you break ground.

It begins when the need for new plant facilities is recognized and engineers are called into action. Then it develops on the drawing board—through plant layouts, working drawings, engineering specifications. It requires consideration of engineering and production techniques—analysis of all factors that must be taken into account before construction can start.

Ebasco skilled engineers and constructors have experience in every phase of the building process—from preliminary planning right up to a plant's successful operation. This experience has enabled Ebasco to complete more than two billion dollars' worth of new plant design and construction for many industries, in many parts of the world.

The engineering and construction firm you select to design and build your plant may well hold the key to its future success. If *you* are considering such a project, send for our booklet, "The Inside Story of Outside Help." It describes our engineering and construction services as well as the wide range of consulting services Ebasco offers business and industry. Write: Ebasco Services Incorporated, Two Rector Street, New York 6, N. Y.

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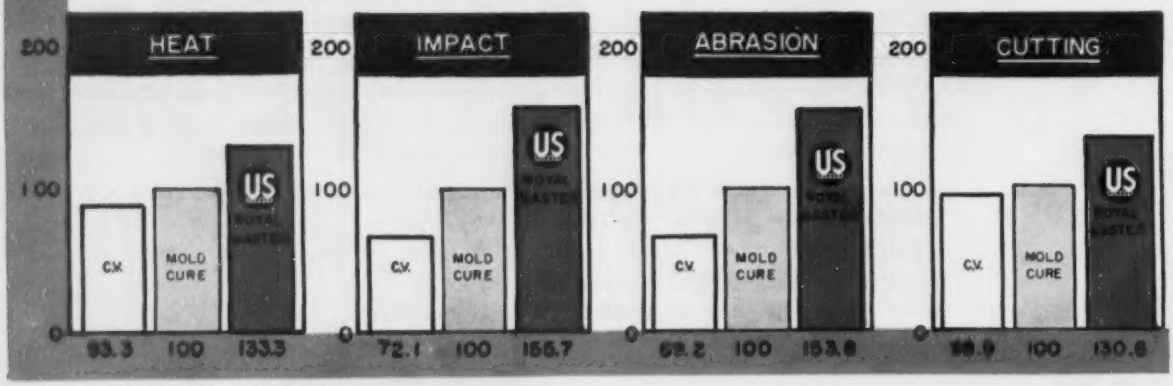
STARTLING

Comparative performance of portable cords related to major life factors.



New U. S. ROYAL MASTER portable cord

PROVES SUPERIOR TO ALL OTHERS IN EVERY SERVICE FACTOR!

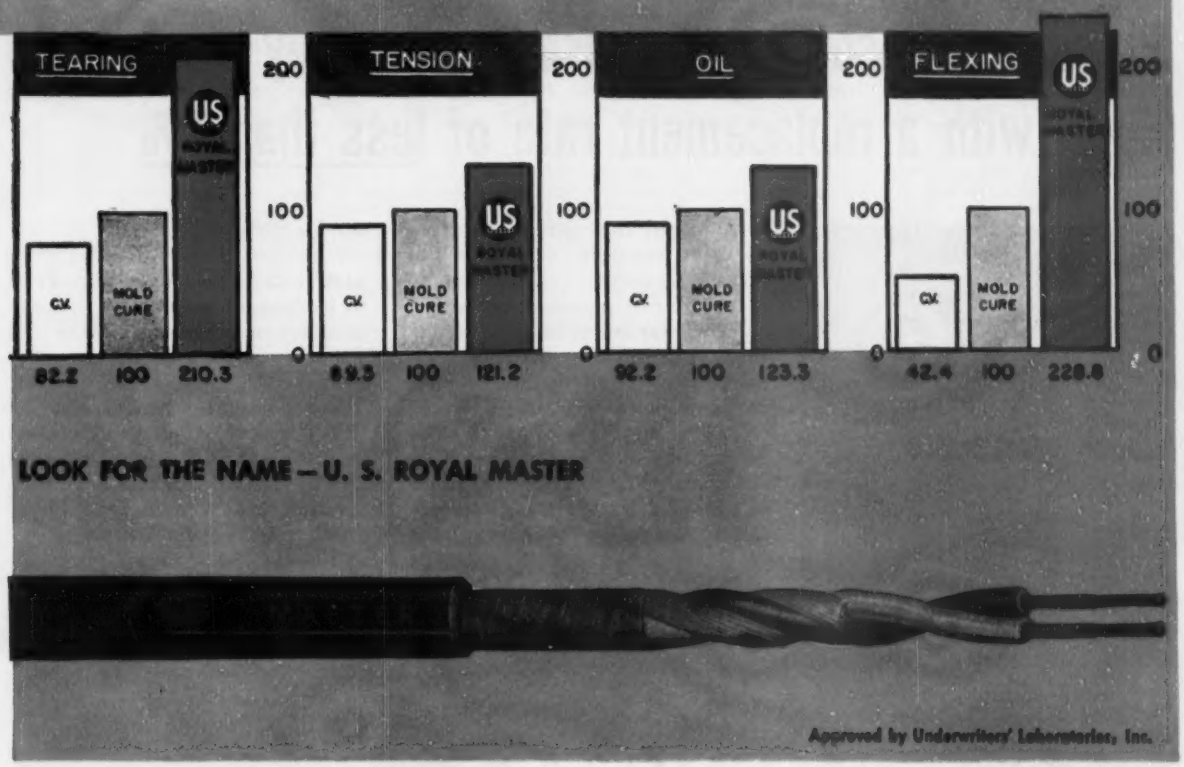
Newly developed U. S. Royal Master Cord gives almost twice the service of other molded cords — gives $1.88 value for every cord $1.00!

Life factor charts illustrate outstanding superiority of new U. S. Royal Master over the average of both the molded cords and the short-lived continuous vulcanized cords of other makes.

US RUBBER

UNITED STATES
ELECTRICAL WIRE & CABLE DEPARTMENT

EVIDENCE!



LOOK FOR THE NAME—U. S. ROYAL MASTER

Approved by Underwriters' Laboratories, Inc.

Cord construction completely reexamined. Over two years ago, U. S. Rubber engineers began a thorough reexamination of electrical cord design and construction. More than a thousand cords, including those of all major competitors as well as our own U. S. Royal Cord, were thoroughly and painstakingly analyzed. Over 10,000 tests were made to determine the principal causes of cord failure.

Every possible life factor was carefully and honestly appraised to find its relation to overall cord service.

With the findings at hand, "U. S." Engineers then drew upon their 64 years of experience in the manufacture of fine quality wire and cable to produce this exceptional new cord.

Every fault uncovered by the exhaustive two-year testing was tackled and solved.

Tested and proved. The new U. S. Royal Master was then tested against all competitive cords—installed in outside plants for final on-the-job corroboration.

U. S. Royal Master Cord proved itself to be unquestionably the finest cord you can buy! So superior, it gives almost double the service life of the average of competitive molded cords—actually gives you $1.88 in value for every cord dollar!

Prove for yourself the outstanding superiority of new U. S. Royal Master Portable Cord—in both service life *and* economy! Get in touch with your "U. S." distributor today!

RUBBER COMPANY
ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Here's Proof of Performance...

Pressure-creosoted poles used exclusively since 1929 with a replacement rate of less than 1%

● A blight that affected native chestnut wood in 1927 turned a major Connecticut power company to the use of pressure-creosoted transmission line poles. The results were so satisfactory that the company has used nothing but pressure-creosoted poles since 1929.

Today, one of the company's operating divisions has 37,877 pressure-creosoted poles carrying 866 miles of overhead installations. Replacements, except for relocations have run less than one per cent.

Pressure-creosoted poles have proved themselves in actual service to be long-life poles. And you can count on top performance when USS Creosote is used in the treating process.

For complete information on USS Creosote, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

THIS PRESSURE-CREOSOTED POLE has been in service for 20 years and will be re-used after grading relocation. Its excellent condition at the ground line is apparent.

THESE PRESSURE-CREOSOTED Southern yellow pine poles have been in the ground at this location in Connecticut for 22 years. Not one pole has been lost to ground rot since installation.

USS CREOSOTE

4-1690

UNITED STATES STEEL

ALLIS-CHALMERS presents

1 **10-Acre Acoustical Proving Ground**

2 **Mobile Sound Research Unit**

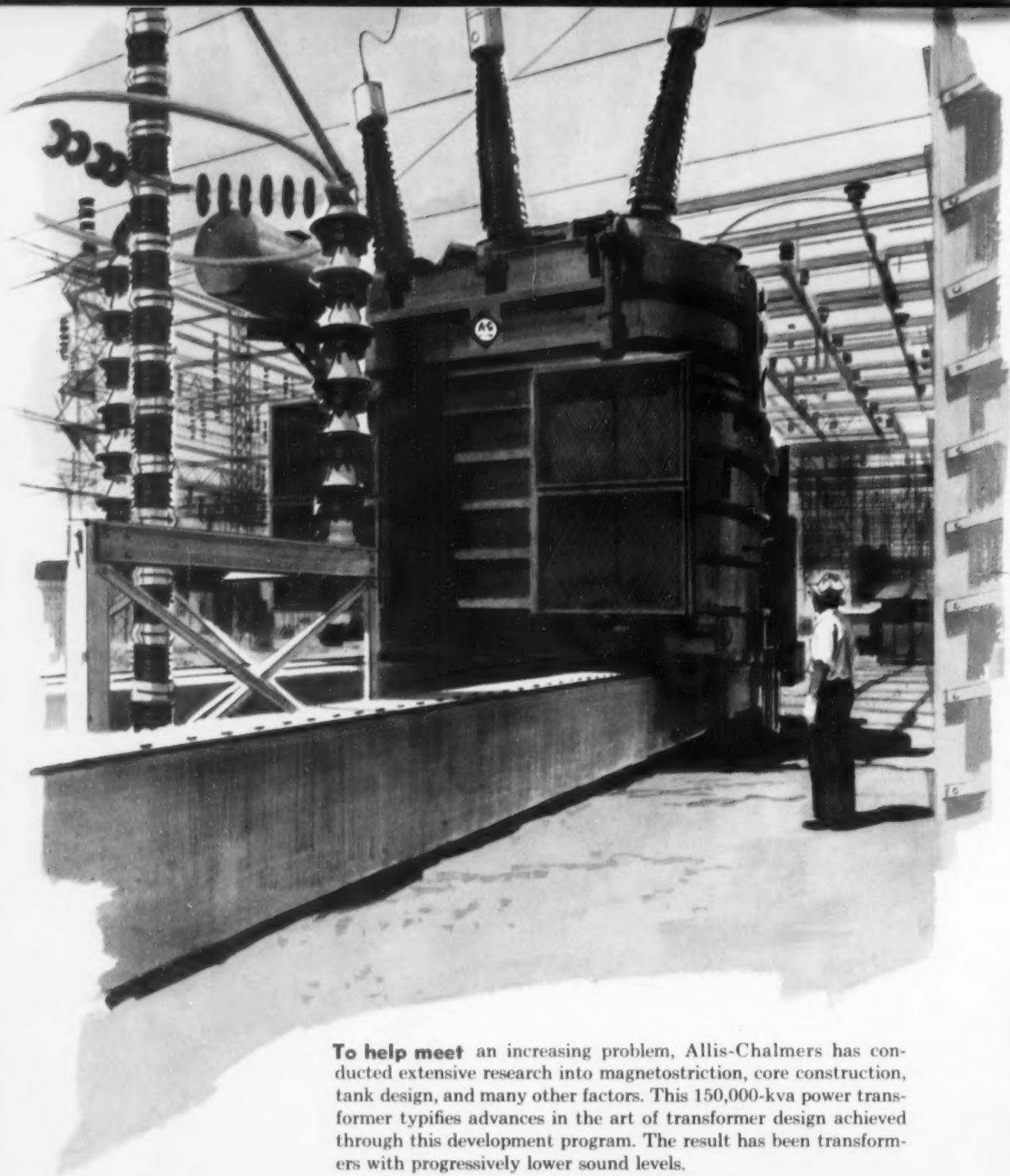
3 **Allis-Chalmers Sound Laboratory**

Transformer Acoustical Survey Service

A-4503

ALLIS-CHALMERS

Milwaukee 1, Wisconsin



To help meet an increasing problem, Allis-Chalmers has conducted extensive research into magnetostriction, core construction, tank design, and many other factors. This 150,000-kva power transformer typifies advances in the art of transformer design achieved through this development program. The result has been transformers with progressively lower sound levels.

Present progress in research indicates promise of even lower sound levels produced economically in transformers of the future. Investigations into the problem indicate, however, that there may be steps utilities can take now to bring about solutions to problems caused by sound. The new Acoustical Survey Service is designed to place in the hands of utilities the advanced techniques and equipment necessary.

Meanwhile, through constant research and ever-improving manufacturing techniques, Allis-Chalmers will continue to bring utilities better and more economical transformers to meet the demands of an expanding power industry.

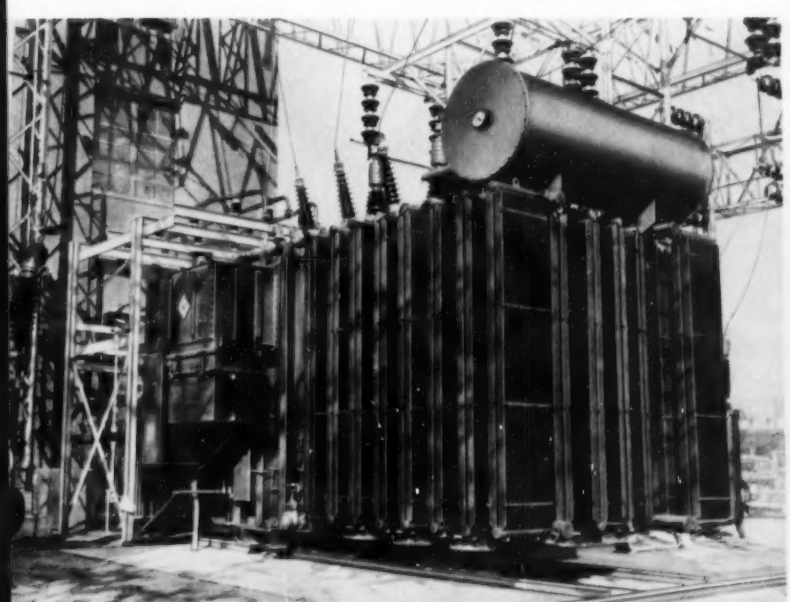
Transformer Acoustical Survey Service

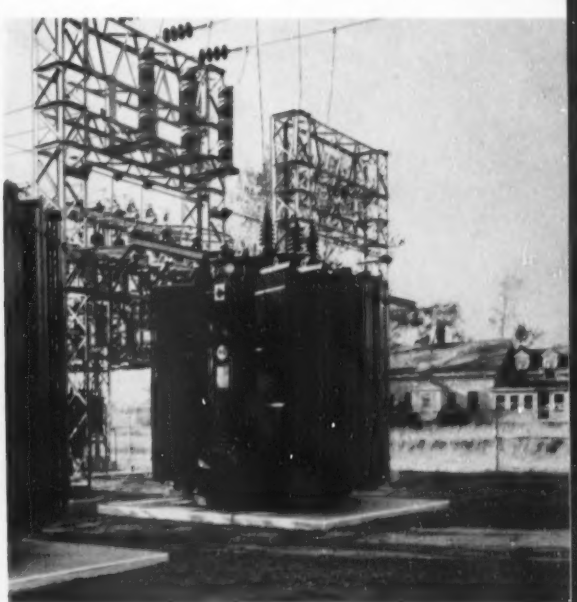
Analyzing A Problem Before It Grows

ALLIS-CHALMERS is introducing a new Acoustical Survey Service to provide utility engineers a means of coping with the problems caused by the installation of progressively larger transformers. Now utility engineers will be able to analyze problems caused by noise levels even before purchasing a new transformer for addition to an old substation or the construction of a new one.

Here's how the Acoustical Survey Service works: With the Allis-Chalmers mobile sound research unit you can analyze many of the phases of sound problems in a given area. You can examine problems caused by contour, landscaping, location of buildings, and many other causes of noise in the area.

With this data you can make use of either the Allis-Chalmers sound laboratory or the Ten-Acre Acoustical Proving Ground. The next few pages outline the extensive facilities Allis-Chalmers is providing to utility engineers for this purpose.



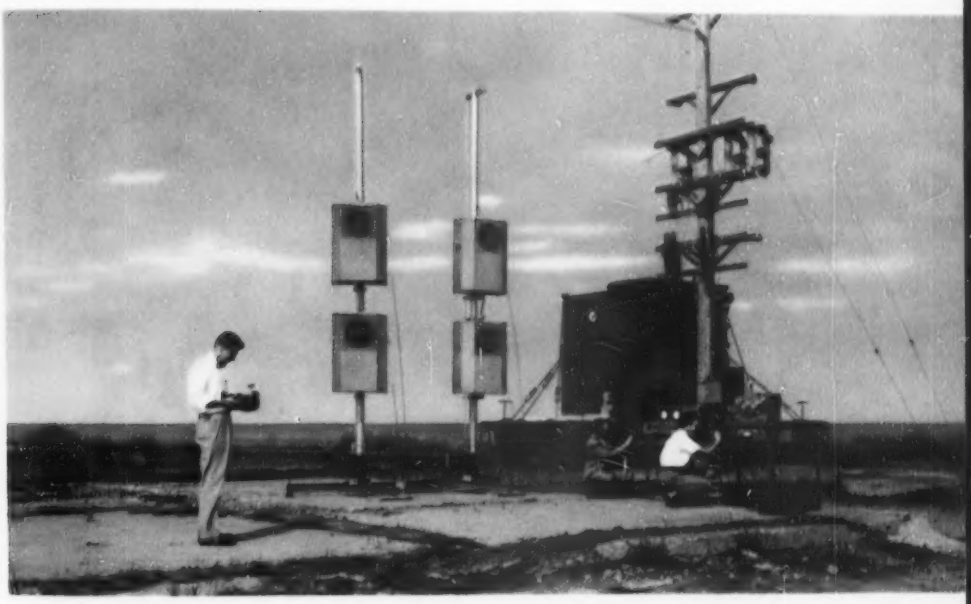


Ten-Acre Acoustical Proving Provides First Practical Means for

Low sound levels and unlimited space make the new Allis-Chalmers Acoustical Proving Ground at Carrollville, Wisconsin, the first *practical* means for field-testing transformers. Ambient sound levels are lower than those which might be encountered at most installations where noise may cause a problem. And space requirements of any standards are far exceeded. There is no reflective surface within hundreds of feet of the transformer location.

Complete testing facilities are available to simulate field problems. In addition to low ambient levels and unlimited space, the Proving Ground equipment includes means for duplica-

AERIAL VIEW OF PROVING GROUND shows transformer which has been moved in on specially constructed railroad spur. Transportation facilities can handle largest transformers, or an acoustical transformer can be used to reproduce the sounds of any size or type transformer.



Ground Sound Level Testing

tion of any area acoustically. Brick walls, Fiberglas-insulated walls, landscaping or any type of equipment that helps improve sound levels can be simulated. There is also adequate space to construct any of the necessary baffles or walls to meet the requirements of a specific test.

Transformer Acoustical Survey Service

Transformer Acoustical Survey Service

Mobile Sound Research Unit Brings Laboratory Equipment To Your Own Area

As part of Allis-Chalmers Acoustical Survey Service the Mobile Sound Research Unit places a means for analyzing sound problems directly in the hands of utility engineers. With this unit you can test or record the aspects of a sound problem right on the spot where it occurs.

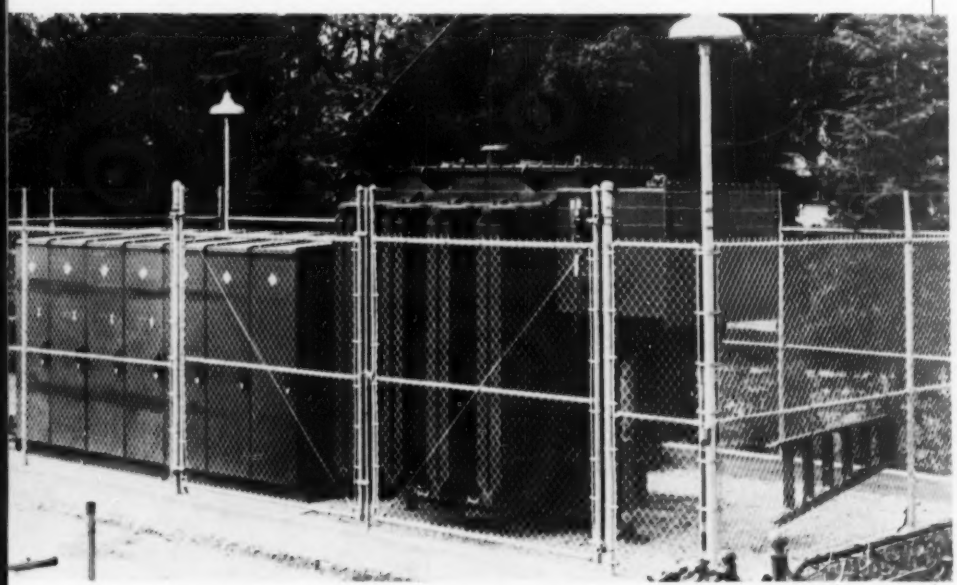
Or you can test areas where substations are planned, deciding on the basis of these measurements the sound level to which a transformer should be designed. The mobile unit will also help decide what remedial steps can most economically be taken if a sound problem develops after a transformer or substation is installed.

The evidence gained from on-the-spot tests can be taken to the Acoustical Proving Ground for further tests. Or you can place an acoustical transformer — which will exactly simulate the sound of an actual transformer of any type or rating — in the new substation area to check the effect on surrounding areas. Thus the exact sound conditions can be established long before the final decision on equipment has to be made.

Allis-Chalmers Mobile Sound Research Unit includes equipment necessary to make tests on almost every phase of a sound problem. In addition, Allis-Chalmers will provide experts who will operate equipment and advise you on the most effective testing to get answers to your questions.

Duplicate Your Area At Acoustical Proving Ground

With data obtained from these tests, you can duplicate the sound problems of your own area at the Acoustical Proving Ground. There Allis-Chalmers will set up similar conditions. In addition, Allis-Chalmers will provide acoustical transformers that will duplicate the noise levels and frequencies created by transformers of whatever rating and type you choose. You can then analyze, *in advance of purchase of any equipment*, the noise levels that will be created by addition of a transformer to your own substation.

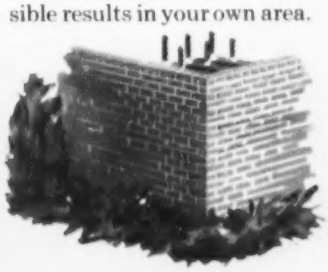


Make Acoustical Tests In Your Own Substation

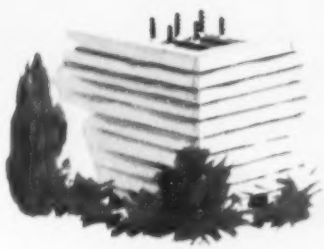
If desired, an Allis-Chalmers acoustical transformer can be set up at your location. When noise levels are created exactly equivalent to those caused by operation of the size and type transformer you choose, you can check all parts of the area with the Mobile Research Unit to determine acceptable sound levels.

Choose Best Solution For Specific Area

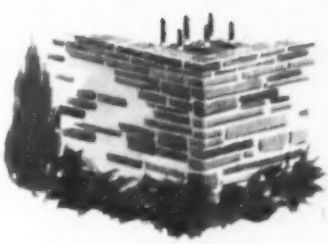
The facilities provided by Allis-Chalmers Acoustical Survey Service will help you decide which is the best and most economic means for solving a sound problem. Brick walls, Fiberglas-insulated walls, wooden walls, stone, landscaping can all be tested and analyzed for possible results in your own area.



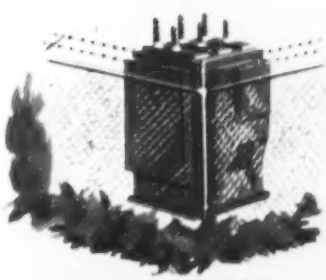
BRICK



WOOD



STONE



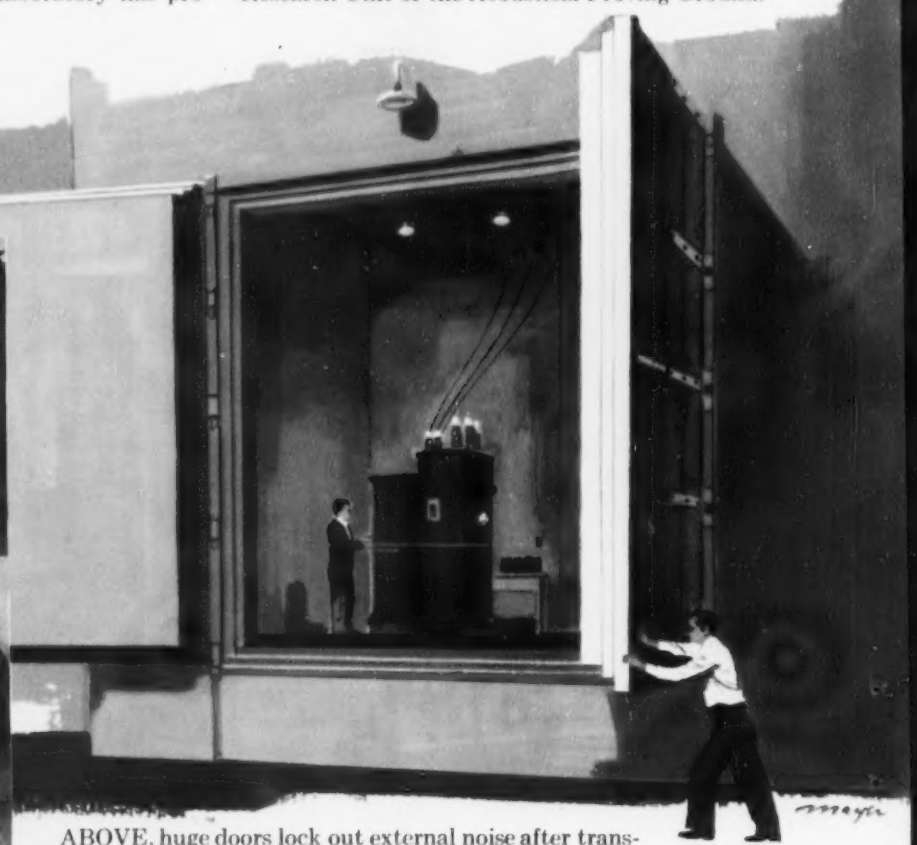
LANDSCAPE

Allis-Chalmers Sound Laboratory Provides Research In Magnetostriction and Resonance

Modern, complex equipment for accurate audio sound measurement under laboratory conditions is housed within the thick walls of concrete, glass wool and acoustical barriers of the Allis-Chalmers Sound Laboratory at Pittsburgh. This building has its own foundation — it is completely isolated from manufacturing disturbances.

Intensive research at the laboratory has produced data that helps design uniformly quiet transformers through a wide range of sizes. Proof has come from field tests which have shown reduced sound levels at transformer installations.

Where advisable, the facilities of the Allis-Chalmers Sound Laboratory will be available to recheck or analyze data developed from the Mobile Research Unit or the Acoustical Proving Ground.

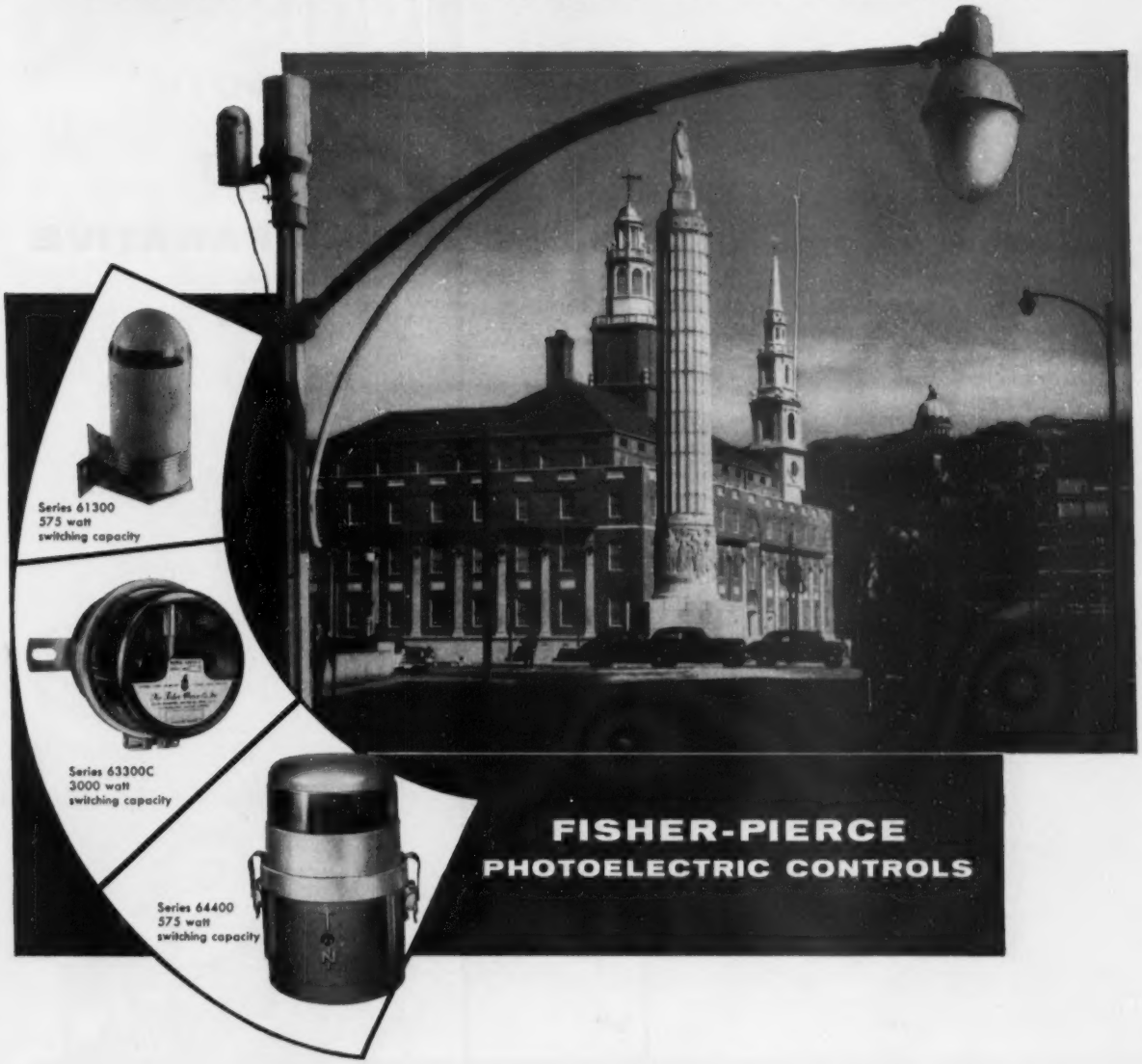


ABOVE, huge doors lock out external noise after transformer is in position for testing. At upper left, noise is analyzed for harmonic content on an experimental core. Below left, a distribution transformer gets audio sound level tests. Frequency analyses of transformer noise and harmonic index are among new tools in the measurement of sound energy.

ALLIS-CHALMERS

Milwaukee 1, Wisconsin

CONTROLLING STREET LIGHTS IN PROVIDENCE, R. I.

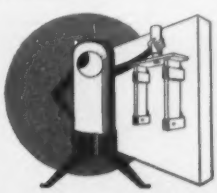


Motorists and pedestrians in Providence can thank their City Government for authorizing The Narragansett Electric Company to install dependable, automatically controlled street illumination.

The use of Fisher-Pierce street lighting controls assures dependable *automatic* illumination of streets the moment daylight drops below a safe value. Because F-P controls are photoelectric, they operate regardless of the hour, the season or the weather.

On the job in Providence since 1946, F-P controls now number about 3000. Narragansett engineers report favorable installation economics *and* an extremely low failure rate — only 2.29% of *all* units during a recent 12-month period.

Long, dependable service of F-P controls — in street lighting control systems in Providence and hundreds of *other* communities — is the basic reason Fisher-Pierce is recognized as a *leader* in its field.



THE
FISHER-PIERCE
COMPANY, INC.
82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILLIPS EXPORT CORP.
DIVISION OF NORTH AMERICAN PHILLIPS
100 E. 42ND STREET
NEW YORK 17, N. Y.

IN CANADA:
NORTHERN ELECTRIC CO., Ltd.

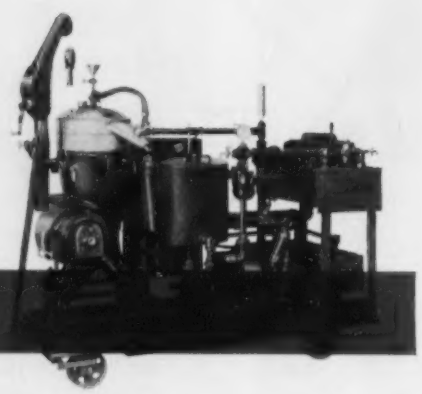
2-MINUTE 6-POINT COMPARATIVE CHECK

. . . for your insulating oil purification method

Two minutes and a pencil are all it takes to determine whether your present equipment for maintaining transformer and circuit breaker oil measures up completely to the requirements of the job.

Here is a simple way to compare its performance with that of a De Laval Insulating Oil Purifier. . .

	PRESENT METHOD		DE LAVAL PURIFIER	
	YES	NO	YES	NO
Reduces water content of new oil at 90° F from an initial 1/10 of 1% to 1/000 of 1% (35 kva dialectric strength)			✓	
Completely dehydrates with a single pass			✓	
Continuously discharges removed water, eliminating possibility of recontamination			✓	
Purifies at low temperature, avoiding carbonization danger			✓	
Operates without shut-downs during run for cleaning or renewing of parts			✓	
Operates at low cost			✓	



Because of their superiority, demonstrated in comparison tests such as this, De Laval Insulating Oil Purifiers are used by the majority of large American power companies. De Laval's dehydrating performance is guaranteed! Write for complete information . . . right now!

DE LAVAL

insulating oil purifiers

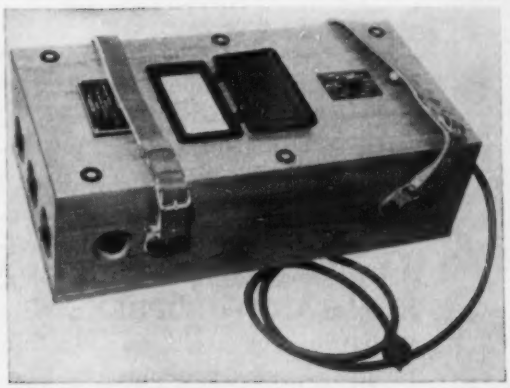
THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5

BIDDLE *Instrument News*

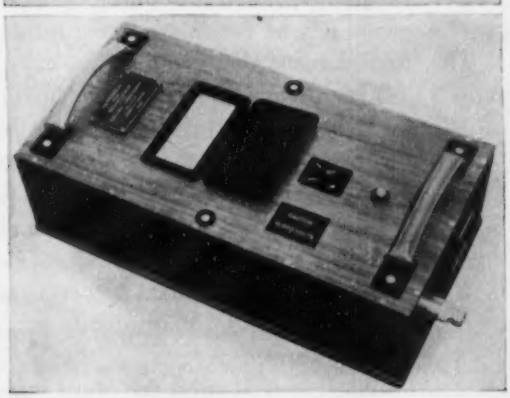
NEW PRODUCTS

RECTIFIER OPERATED, HIGH-RANGE MEGGER® INSULATION TESTERS

Triple and Single Voltage Models



Triple-Voltage
5000, 2500 and
1000 Volts d-c
Up to
100,000 Megohms



Single-Voltage
10,000 Volts d-c
Up to
200,000 Megohms

The high ranges now available in "Megger" Insulation Testers are extremely useful in several kinds of field tests. In the case of bushings, the insulation resistance of new units should be in the order of 50,000 megohms, and any deterioration that may occur in service, which can be detected at 2500 volts d-c, will be quickly observed with a "Megger" Instrument, of that range and voltage. The high-range "Megger" Instrument in ranges up to 200,000 megohms and ratings up to 10 kv, therefore, gives the maintenance engineer a simple and relatively inexpensive tool for detecting the deterioration in bushings in its early stages.

Generators, transformers and cables can have relatively high 1-minute insulation resistance values which may increase with time during a time-resistance test. In such cases—and they are frequent—the instrument range should be high enough to permit observation of this increase of resistance with time.

These are only a few of the many applications for these instruments. For complete information on all hand-, motor-, or rectifier-operated, high-range Megger Testers request **Bulletin 21-20-EW.**

Biddle Dielectric Test Set Model 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Overall dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for **Bulletin 22-EW.**

James G. Biddle Co.
1316 Arch St., Phila. 7, Pa.
Gentlemen: Please send me
☐ **Bulletin 21-20-EW**
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JOB FUNCTION
COMPANY
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ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

gates lighted with "WET" wire

Fifty feet of water behind this head wall furnish almost two million gallons per minute to make 13,800 volts of hydroelectric power. Flow is controlled by two 20-ton penstock gates which are operated by a remote-control gantry crane.

Head wall lighting wire, providing current to illuminate this vital operation, has to withstand condensation in conduits without sacrificing size, weight, or flexibility. Simplex-ANHYDROPRENE Wire with Anhydrex insulation and a thin neoprene jacket was purchased because it was considered best qualified to meet these conditions.

Anhydrex water-resistant rubber insulation gives excellent moisture protection. Anhydrex eliminates lead sheaths. ANHYDROPRENE is more flexible because of its small size and light weight. A thin neoprene jacket provides protection against abrasion, flame, oil, sunlight, and mildew.

Whether it is used for plant wiring, remote control, underground primaries or just plain lighting, ANHYDROPRENE offers dependable service and long life. More detailed information is contained in Bulletin No. 115. Write to the address below for a copy.

Simplex-ANHYDROPRENE

. . . ANHYDREX INSULATED WATER-RESISTANT LIGHTING WIRE

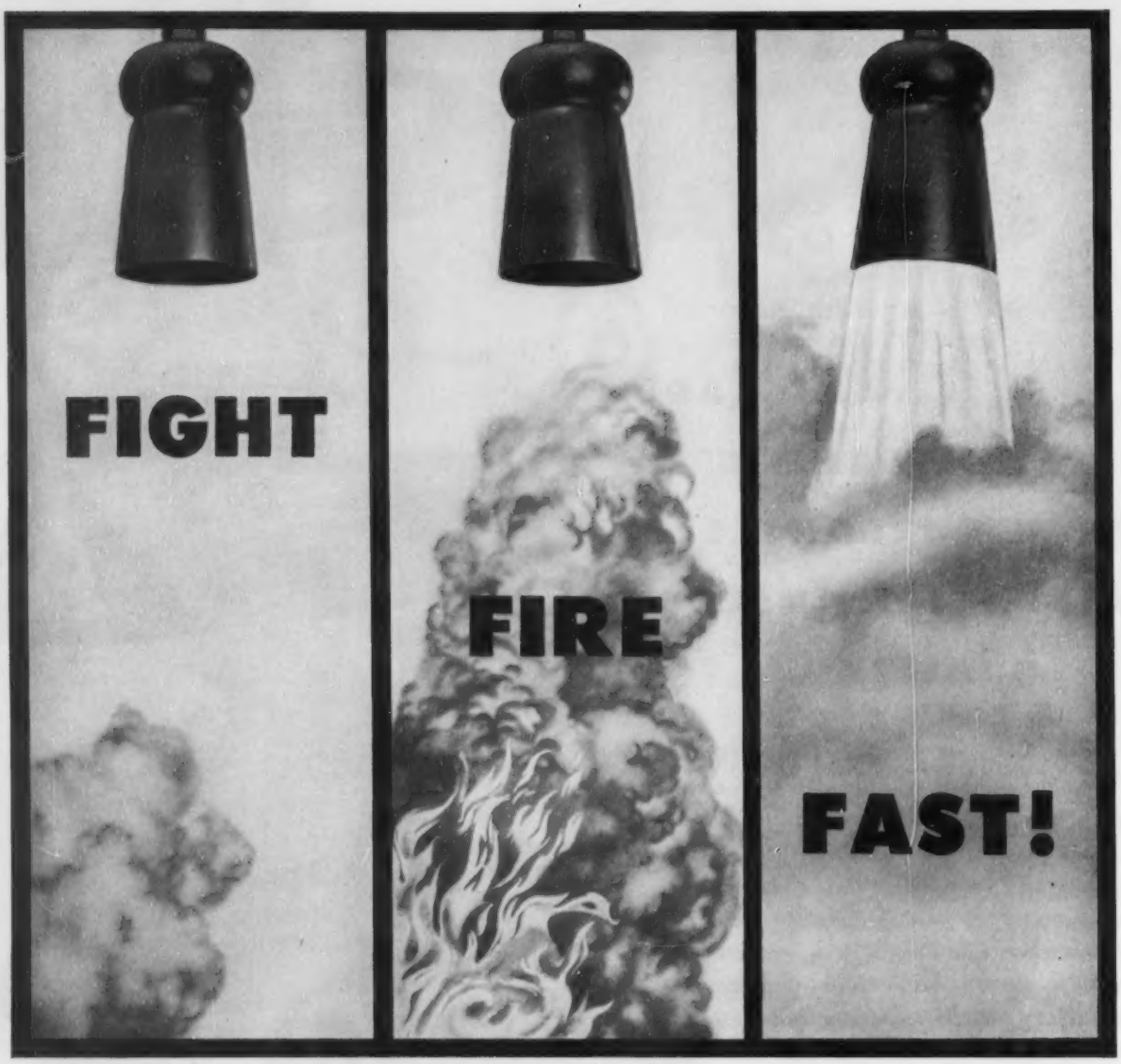
SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

IT'S THE PORCELAIN
THAT INSULATES

...AND LAPP PORCELAIN IS YOUR GUARANTEE OF SUSPENSION INSULATOR QUALITY

Lapp is the maker of porcelain insulators and insulating components which provide *an extra margin of operating security . . . long life . . . low upkeep and maintenance.* And nowhere is the importance of "Lapp quality" porcelain (and Lapp assembly) greater than in suspension units for transmission line duty . . . The specification *"Lapp Suspension Insulators"* is low premium insurance of long trouble-free service for your lines. Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp



WITH A KIDDE CO_2 SYSTEM!

Let fire get a foothold, and a going concern is *gone*. Don't risk it. Install a Kidde Automatic CO_2 Fire Extinguishing System, and fire won't stand a chance.

A Kidde System goes into action at the first sign of fire—releases clouds of CO_2 over the blaze, smothers fire almost as soon as it starts. And CO_2 leaves no mess to clean up later. It puts out the fire, then vanishes.

Protect motors, generators, switch gear—all electrical equipment with a Kidde System.

And for on-the-spot protection, get Kidde portables. When fire strikes, just aim the horn, pull the trigger, and *swoosh!* No more fire.

Don't wait 'til your business is a cinder pile—Contact Kidde today.

Kidde (K Kidde)

The words 'Kidde', 'Lux', 'Lux-O-Matic' 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

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A DEPENDABLE COMBINATION

WHEN SHORT CIRCUIT CAPACITIES EXCEED STANDARD LEVELS

TYPE WAG SWITCH WITH *AMPLITACT*
TRADE MARK

The changing complexion of power systems all over the world, with the trend toward higher and higher short circuit capacities, is imposing more stringent duty requirements on transmission level equipment than ever before.

As there arose in the utility industry the need for a switch that could be safely applied on systems where short circuit capacities exceeded standard levels, Southern States developed and incorporated in its Type WAG Air Break Switch an entirely new contact design . . . the *Amplitact*.

This new contact has proven, in nation-wide installations, to be the answer to extreme system short circuit conditions that are now being accepted as normal by many utilities.

THE AMPLITACT AND HOW IT WORKS

Current passing from a switch blade through conventional contacts tends to relieve contact pressure. The relationship between members is such that magnetic forces, developed by current flow, oppose contact spring forces. Such magnetic forces are not great at rated load or relatively low fault currents, but at higher currents they become considerable and at some value of current they will completely relieve pressure, resulting in contact failure.

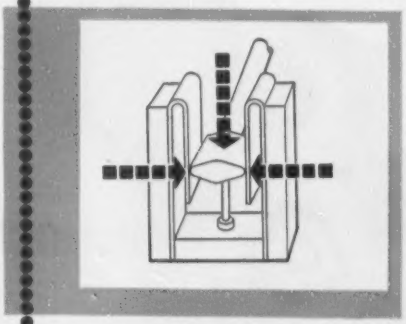
The *Amplitact* puts these negative forces to work in the following manner:

The schematic drawing, lower right, traces current through the *Amplitact*. Inner segments of loops are resilient and outer segments are fixed against rigid abutments.

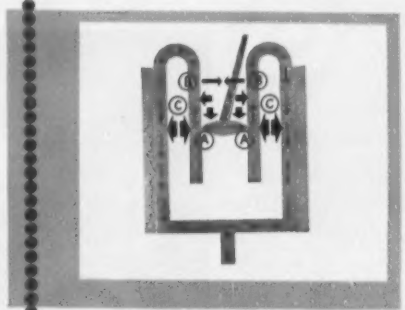
A. Current flowing through the blade changes direction 90° when current interchange is made at junction of blade tip and resilient contact. Resultant forces from these changes in current direction materially assist in holding the blade in the closed position.

B. Two parallel paths are formed for the current in the two resilient segments. Since the current is flowing in the same direction, these conductors tend to attract—thus increasing contact pressure.

C. Two parallel paths are also formed by the fixed and resilient segments. However, in this case the current is flowing in opposite directions in conductors in close proximity. The result is a powerful force from opposing magnetic fields which amplifies contact pressure in proportion to the square of the current flowing through the loops.



The above schematic drawing shows the relative electromagnetic forces resulting from current flow through the reverse loop members of the *Amplitact*. These forces greatly increase contact pressure and positively hold the switch blade in the engaged position.



WHEN AMPLITACT IS SUPPLIED

The *Amplitact* is a heavy duty premium contact supplied on all ratings of the Type WAG 1600 amperes and above. It is not supplied on switches rated 400 and 600 amperes. In switches rated 1200 amperes availability varies as follows:

7.5 KV—34.5 KV	Amplitact supplied
46 KV—161 KV	Standard Contact or Amplitact Optional*
196 KV and above	Standard Contact

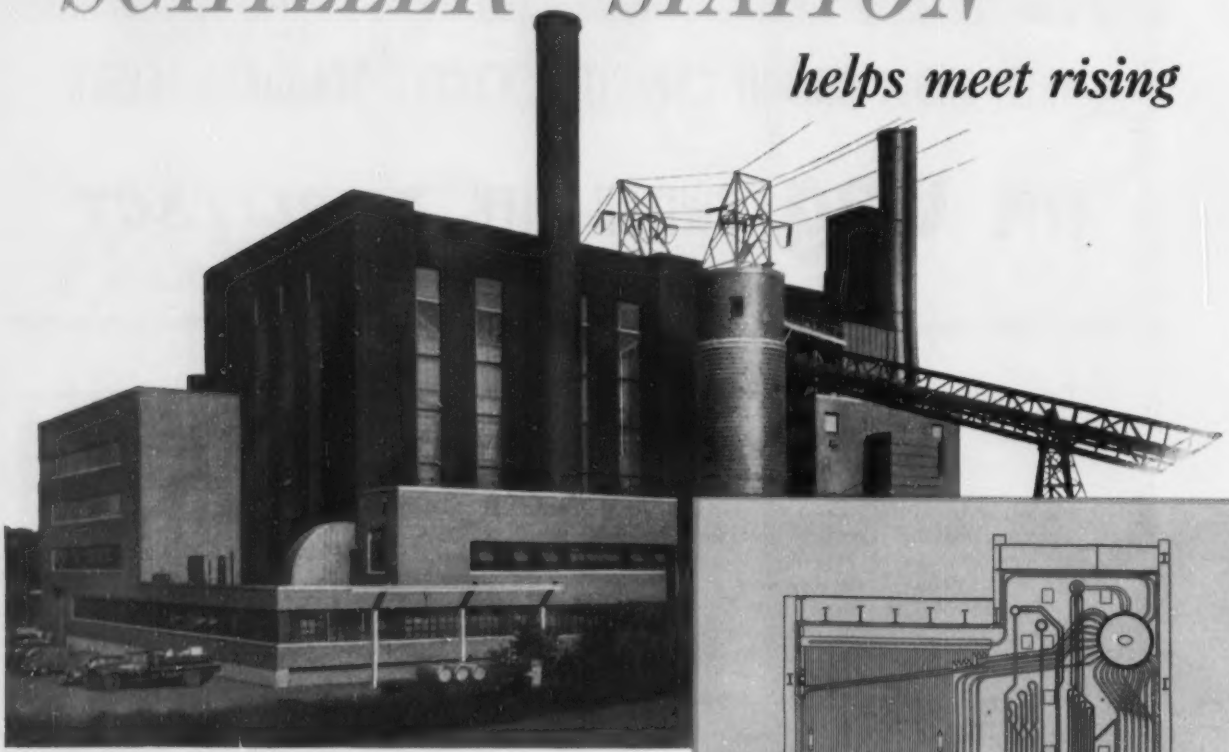
*An extra charge is made for the Amplitact when it is specified in the 46 KV—161 KV, 1200 ampere ratings.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

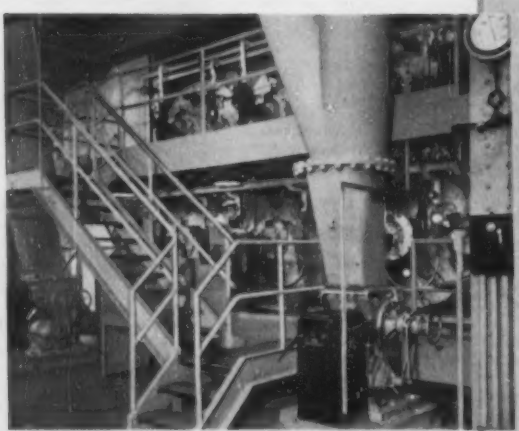
IN CANADA:
Dominion Cutout Co., Ltd., Toronto

SCHILLER STATION

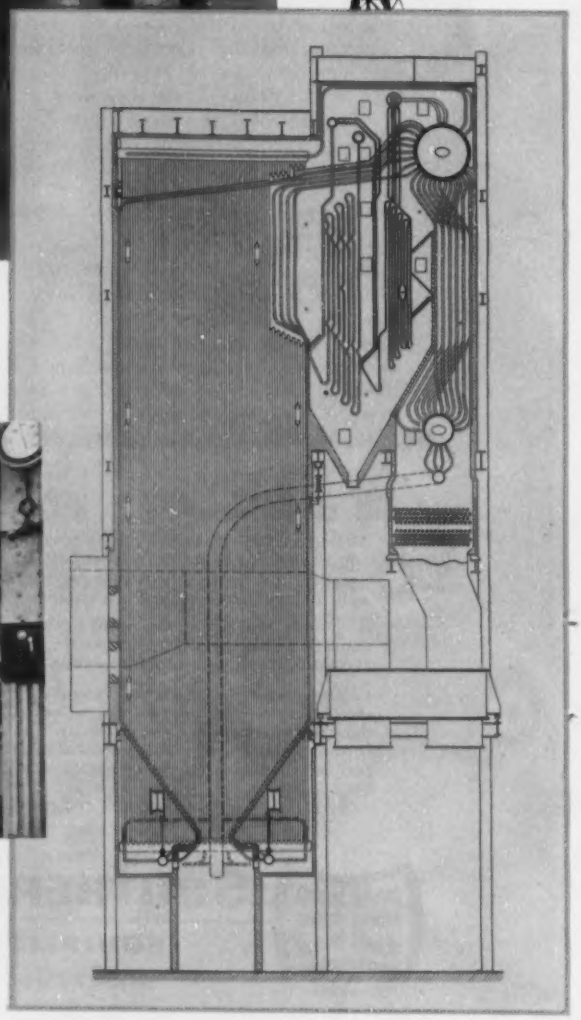
helps meet rising



Looking east toward Schiller Station and the Piscataqua River. Addition housing FW steam generator now being erected on the right of the present structure. Consulting Engineers: Jackson & Moreland, Boston, Mass.



View showing oil burners serving Foster Wheeler boiler. Fuel consumption 65 gallons of oil per minute.



Cross-section of one of two identical Foster Wheeler 2-drum steam generators at Schiller Station, Portsmouth, N. H. Design pressure 1475 psig; final steam temperature 950F peak capacity 450,000 lbs per hr.

demand for electric service in New Hampshire

Foster Wheeler 450,000 lb per hr steam generator, installed in Schiller Station of Public Service Company of New Hampshire, has augmented station's capability by over 50,000 kilowatts. A second Foster Wheeler unit, now under construction, will contribute an additional 50,000 kilowatts to the rapidly growing power-producing facilities of this business-managed utility.

Reddy Kilowatt

SCHILLER STATION of Public Service Company of New Hampshire was first opened in 1950. But, to meet the ever-growing demand of New Hampshire's thriving industries, farms and homes, in the four short years that have passed, Public Service has found it necessary, upon two occasions, to increase the power-producing facilities of this station.

In the first addition, a two-drum Foster Wheeler steam generator — complete with superheater, economizer and waterwalls as shown in the accompanying cross-section — was installed. This added 50,000 kilowatts to the station's capability. For the second addition, now being constructed, an identical Foster Wheeler steam generator is specified that will contribute an added 50,000 kilowatts.

This installation is another example of Foster Wheeler's ability to design and construct equipment to meet exacting power-producing needs — equipment that reflects the engineering ingenuity of an organization long recognized as a pioneer in the field of steam generation. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

**Trade mark character used by permission of Reddy Kilowatt, Inc.*

FOSTER WHEELER

HOW ANACONDA SOLDERSEALED POTHEADS ARE MADE

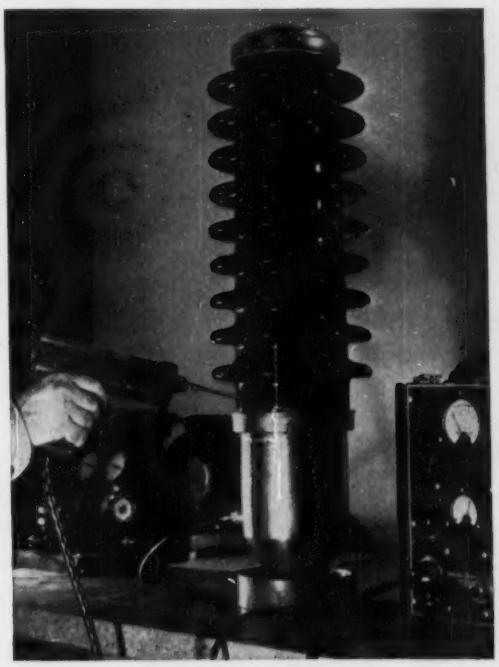
Above. First step in the Anaconda soldersealed process consists of painting and then baking a band of silver on the glazed surface of the insulator so that the resulting metallic band is permanently fusion-bonded to it. This band is then copper-plated. The plated band and the spun-copper fitting are tinned over-all.

Left. During assembly, the hood and wiping nipple are sealed to the porcelain by pouring solder into the joints under controlled conditions.

Above right. After assembly, all factory-made solder seals are tested with gas under pressure to assure tightness.

A NEW SERVICE FOR CABLE USERS:
ANACONDA SOLDERSEALED POTHEADS!

Now — cable users have a *new source of supply* for Soldersealed Potheads. And Anaconda's full inventory of parts assures *prompt* delivery to customers.



ANACONDA Soldersealed Potheads end all gasket problems — because they have no gaskets. The metal housings of these potheads are soldered directly to the porcelain — at our factory. There are no gasketed joints to make in the field.

Soldersealed Potheads are easy to install. *And soldered seals are tight!* Where gas- or oil-filled cable is used, this type pothead gives greatest service satisfaction.

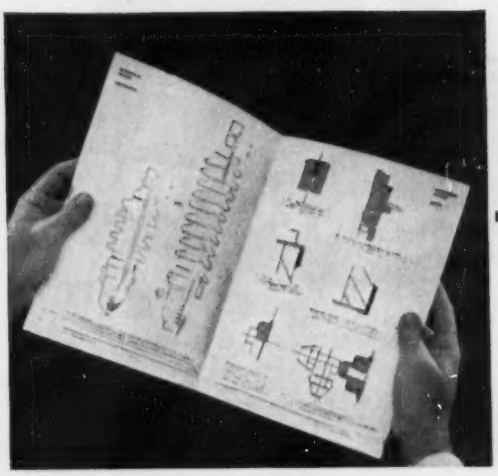
PROMPT DELIVERY

ANACONDA Soldersealed Potheads are stocked, ready for delivery, in single conductor, outdoor type, 15,000-46,000v for all conductor sizes.

Ask your Anaconda Sales Office or Distributor for full information. And write for Anaconda's new Soldersealed Pothead catalog.

Soldersealed Potheads

ANACONDA®



18-PAGE CATALOG Most-up-to-date catalog on Soldersealed Potheads. Eighteen-page, illustrated booklet with detailed, factual information useful to both engineer and installer. This catalog simplifies ordering of the *right* pothead for every job. Send for your copy today.

ANACONDA WIRE & CABLE COMPANY, 25 BROADWAY, NEW YORK 4, NEW YORK

☐ Please send me your new Soldersealed Pothead Catalog.

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....

There IS a Difference!

Connectors may look alike but it's PERFORMANCE that counts

BLACKBURN CONNECTORS OUT-PERFORM THEM ALL

Because They Are . . .

BETTER MECHANICALLY

- Made of high strength duronze, a silicon bronze alloy stronger than structural steel.
- Machine cut threads, *CFC treated, provides more thread engagement —reduces friction and increases thread efficiency. *Chemical Friction Control.
- Rigid inspection of each production operation assures uniformly good connectors.

BETTER ELECTRICALLY

- High clamping force—the result of greater thread efficiency breaks down oxide on the conductor improving conductivity.
- Higher initial conductivity, actually greater than an equal length of conductor is maintained permanently.

REUSABLE

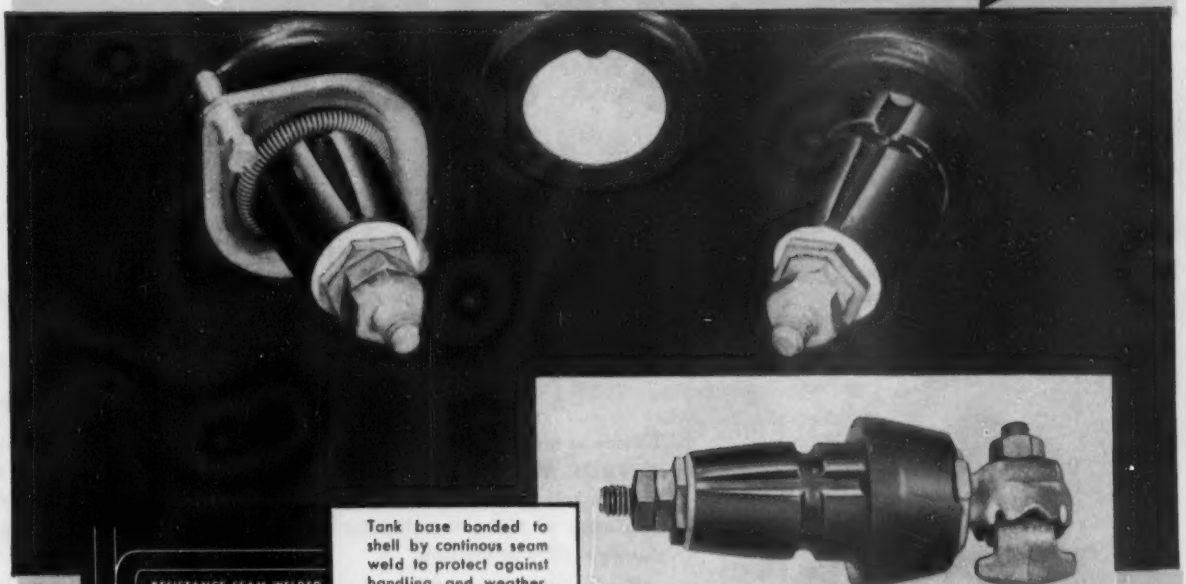
- Selection of proper high-strength, corrosion-resistant materials—plus precision workmanship and inspection—means Blackburn connectors may be used over and over.

AVAILABLE AT ELECTRICAL WHOLESALERS EVERYWHERE

BLACKBURN *Hi-Strength* **CONNECTORS**

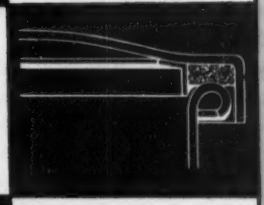
JASPER BLACKBURN CORP., 35 Madison Street, St. Louis 6, Missouri • Phone MAin 1-2821

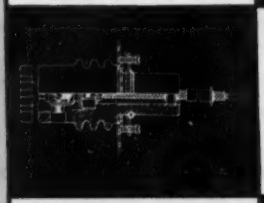
KEY TO SAFETY



Tank base bonded to shell by continous seam weld to protect against handling and weather. Inside edge coated with sealing mastic and rolled in to form lasting barrier against moisture, air and rust.

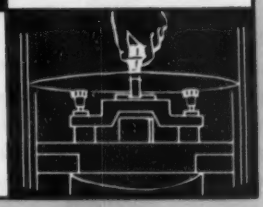
Corprene gasket retained by ring welded to tank cover. Gasket is retained in position forming a perfect tank seal. Gasket is not cemented and can be used again and again.





Moloney sidewall mounted high voltage bushings are provided with a molded, high impact resistant phenolic-cold rubber protective cap for working "hot".

Tap changer operating handle located above hot oil level. Double-moving contacts snap into position with a wiping action to assure positive contact.



Key and slot mounting of Moloney HiperCore Transformer *low voltage* bushings literally locks them to safety . . . gives your linemen solid leverage for tools. These bushings can't slip or turn under torque. Safety is inherent, too, in the sidewall mountings that permit either above or below vertical take off. The solderless type terminals will accommodate conductor sizes according to NEMA standards.

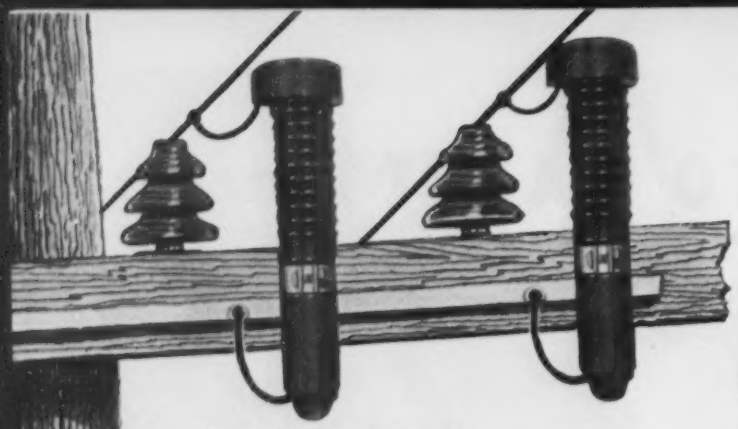
Made of high-strength, dry-process porcelain, the bushings meet utility requirements. Moloney HiperCore Transformer bushings are designed to function under any operating conditions.

Specify Moloney HiperCore Transformers and give your distribution system dependability . . . the mark of Moloney for 58 years.

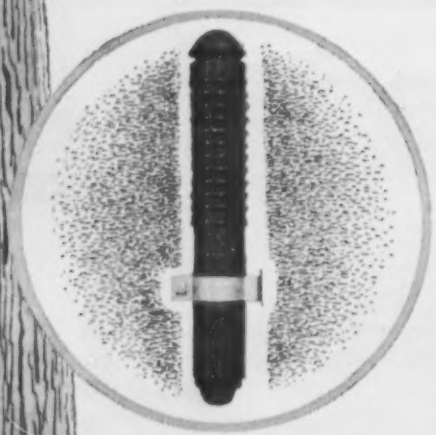
MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers • Load Center Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA



Crystal Valve All-Porcelain Sealed (Non-ventilated) Spark Gap Arrester for Cross-arm Mounting. Line-lead Ground-stud Terminals. Maximum permissible line-to-ground voltages, 3,000 to 18,000.



Crystal Valve All-Porcelain Ventilated Spark Gap Arrester for Cross-arm Mounting. Line-stud Ground-stud Terminals. Maximum permissible line-to-ground voltages, 3,000 to 18,000.

WRITE FOR helpful data folder "Proved Protection," giving all the inside facts you should consider in selecting lightning arresters.

YOU HAVE A CRYSTAL VALVE

1

CROSS-ARM MOUNTING

FOR CV SEALED OR VENTILATED ARRESTERS

Choice of mounting is only one advantage of Crystal Valve Lightning Arresters. Most important advantages to distribution engineers are greatly reduced operating and maintenance costs . . . increased efficiency of the entire distribution system . . . negligible outages during lightning season.

If you use the conventional arrester mounting for distribution transformers, you have two types of Crystal Valve Arresters from which to choose—Sealed (Non-ventilated) and Ventilated Gap Arresters. Both have true valve action in conjunction with high-speed spark gap assembly to interrupt follow current, prevent hazards and fire risk.

CV Ventilated Gap Arresters are protected from corrosion by vents which permit the movement of air, prevent accumulation of moisture in housing. Amazing performance of this arrester under all service conditions proves better than 99% protection.

CV Sealed Type Arresters have the same high-speed multiple spark gap units, the same oxidized Silicon Carbide valve element as the Ventilated Gap Arresters.

Many distribution engineers prefer tank-mounting of Crystal Valve Arresters because of its simplicity, space conservation, efficiency and economy of installation.

Thousands of CV Arresters are giving permanent protection to "power packages" under all types of weather conditions. Many of the leading transformer manufacturers furnish their product with CV Arresters. They know Crystal Valves give unlimited surge capacity at all ratings and can be installed on all types of circuits without regard to system capacity. The four CV-equipped transformers shown here have positive protection against lightning damage, power surges, and harmful over voltage.

CRYSTAL VALVE

LIGHTNING ARRESTERS

2-WAY CHOICE WITH

JOB-ENGINEERED ARRESTERS

2

TRANSFORMER MOUNTING

FOR CV PORCELAIN SEALED OR VENTILATED ARRESTERS

37½ KVA Allis-Chalmers Protected Type CP-1, Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 13,200 GrdY/7620; low voltage, 120/240 volts.

37½ KVA Pennsylvania "Protected Pole Star" Transformer with 9 KV Crystal Valve Arrester. Furnished in sizes 3 KVA through 100 KVA, up to 14,400 volts.

10 KVA Kuhlman CSP Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 7200/12,470Y; low voltage, 120/240 volts.

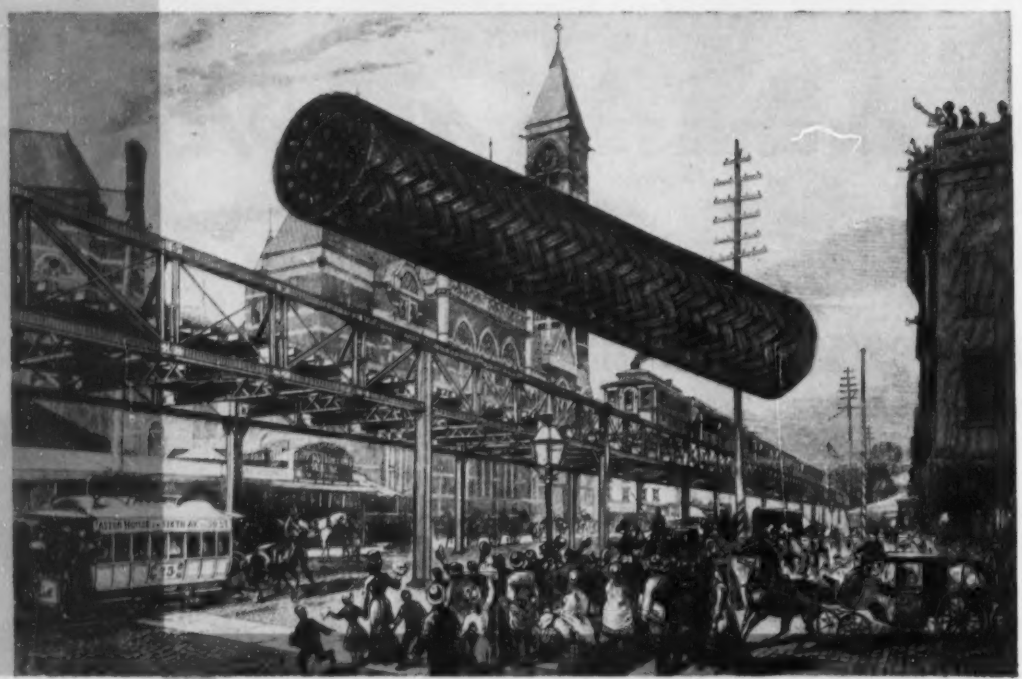
5 KVA Moloney HiperCore Type CSP B-1 Single-phase, 60-cycle Transformer with 3 KV Crystal Valve Arrester.

Electric Service Manufacturing Co.

PHILADELPHIA 32, PENNSYLVANIA

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

Kerite cables aided in the development of New York's rapid transit. Pictured is the first train on the Gilbert Elevated Railroad passing through 6th Avenue, near Jefferson Market Court, April 28, 1878.



DEPENDABILITY

The Kerite Company has been identified with industrial progress in this country for the past century. Poised on the threshold of another century, Kerite remains humbly dedicated to offering the best in quality and service.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
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Here We Go Again

Electric companies and industrial firms by the end of this year will have spent some $8 million for research and study aimed toward the economical production of electric power from atomic energy. By the end of next year the figure may be raised to $20 million if development and construction spending is included.

Among the utilities and the manufacturers the big race is on! The competitive spirit, the provincial pride, the patriotic motives, and the other intangibles that spur our dynamic economy are in full evidence. Company A is in a hot race with Company B. Construction will be underway in New England or Washington State on a full-scale atomic power plant before the wheels are spinning at the 60,000-kw plant near Shippingport, Pa. The nation's 40-odd million residential customers will probably be the first in the world to use large blocks of electric power produced from the fission of uranium.

But while the engineering talent and the managerial skill of the electric companies are turned toward the peacetime development of this new source of energy, the federal power enthusiasts are readying for another ideological battle. Having lost their fight to bottle up atomic power progress in government laboratories, they are out to capture the initiative in a new federal vs private power scrap.

As it is now shaping up, the battle has many of the aspects of the old federal-private controversy over hydroelectric development.

The CIO in its publication, "Economic Outlook," sets the argumentative pattern for the federal power coterie. A recent issue makes this assertion: If privately owned companies can produce power from the atom for 6.7 or 6.8 mills per kwhr, then federal agencies could produce power from the atom for 4.2 to 4.6 mills.

Of course this low federal price depends on the same financing for atomic power projects that the New Dealers applied to federally financed hydro projects. As capital investment in atomic plants will be substantially higher and fuel costs lower than for comparable steam plants, carrying charges become one of the principal expenses. This economic fact plays right into the hands of the federal power backers.

The CIO publication claims these lower federal costs on the basis of using the funds and prestige of the federal treasury to get money at a cost of around 2.5% as compared with a claimed 5.7% for private financing. The other credit on the federal side would come in the form of the usual tax escape. Most private firms must now pay federal and other taxes amounting to some 22% of their gross revenue.

Obviously the CIO has paid little attention to methods the industry is using in financing Electric Energy, Inc, the Ohio Valley Electric Corp, the proposed Mississippi Valley Generating Co, and the less well-known South Carolina Generating Co. These methods involve a lower proportion of equity and consequently lower interest and taxes—enabling private industry to compete with federal efforts. Of course, in a free enterprise economy such methods should be unnecessary, but they do offer a possible approach.

By this time the electrical utility industry has more experience in fighting its battles against federal encroachment in the power business. The industry has successfully pointed out the fallacies of the sort of wishful economics proposed by CIO. The Eisenhower administration is convinced of the folly of this kind of political thinking.

But unless the free enterprise story is told again and again as it relates to atomic power development, setbacks may come in this area. Opportunities available through the Atomic Energy Act passed this year must be used at the earliest feasible date, else they might be whittled away by the federal power crusaders.

Who's on the Offensive?

Gas Appliance Maker Sheldon Coleman is an able spokesman for his industry and a worthy competitor. In his final speech last month as president of the Gas Appliance Manufacturers Association, he came up with a chilling thought for the gas heating business.

The electric heat pump, he told GAMA's convention, threatens to march away with the house heating load and put the gas business in for some rough sledding.

Declared Coleman: "We are moving into one of the most epic struggles in which any two major industries have ever engaged. The electrical industry to offset summer peaks is mobilizing all the power at its command to take on, not just the summer cooling load, but the winter heating load as well."

With the prospect of lower cost atomic-generated electricity plus continued heat pump research and the adoption of special rate structures they stand to make great progress in the next five years. "Yes, gentlemen," he said, "the stakes are high indeed, because our gas heating load is in jeopardy."

What did he suggest the gas people could do about it? "Get off the defensive," he urged. "Develop an all gas heat pump with a gas engine cooling system that is sharply better—sharply different—than anything we know about today."

To do it he proposed an all-out research and development program. It would cost a million dollars over the next four years and would be financed by gas utilities and gas pipeline companies.

Unfortunately, Mr Coleman's concern over the electric heat pump on his side of the fence could only be matched by the apathy on ours. He's alarmed. We're almost indifferent. He needs a weapon for this "epic struggle." We have it. He even asks gas suppliers and distributors for money to devise and make it. Meanwhile their electric counterparts don't have to lay out a penny. The manufacturers already have done it.

Yes, we have the weapon, but where is the fighting force —the electric utilities to do the soldiering and selling? True there are some courageous and active campaigners some of whom deserve great credit. And there are new converts each year. But on the over-all heating front this still amounts to little more than good guerrilla warfare.

"Let's get off the defensive," Gas Man Coleman urges his industry.

Who, indeed, is really on the offensive?

Keeping the Boys on the Farm

One of the great values of electrification of farm production operations is that it takes the drudgery out of the ever-recurring round of chores that must be attended to, come wet, come wind, come hot, come cold. Many a farm boy, crawling from his warm bed into the freezing dark of a winter morning, has promised himself he'd get a job in the city as soon as he was old enough, and then has kept his promise. But when electricity takes over watering the stock and cleaning the barn and generally does the heavy work, then the boy is much more likely to leap from his couch with a glad cry to greet the morn rosy or not, happy with life on the farm.

This is an aspect of farm electrification that never can be emphasized enough. It is right and proper that increased electrification be sold to the farmer on the basis of the money profit he will derive from it. But this is transcended by the greater and more satisfying profit that comes from maintaining the farm family intact, that is realized by farm fathers and mothers when they see their children content to stay on the land. It is gratifying to note that this factor is not being neglected in the promotion of farm electrification.

Electrical World is now organizing a large volume of material from the field for publication in a major editorial feature on the present status and future potential of electricity in agricultural production. The intent is to present economic and business considerations in the convincing language of figures, leaving aside the intangible factors on which arithemetical values cannot be set. But the intangibles continue to assert themselves as the work of organizing the material goes on. The following quotation from the contribution of one utility is typical of the hundreds submitted:

"Certainly Jones's youngsters can look forward to a pleasant and rewarding livelihood with all the real drudgeries eliminated from the farming chores. Even though the boys are just reaching their teens, they are able, with the help of the many and varied pieces of electrical equipment, to handle many of the man-sized and ordinarily difficult jobs."

These boys and thousands like them on farms where electricity has taken hold are not going to leave the land in search of easier life in the city. They will grow up to be better farmers than their fathers, using more electricity, and in their turn making farm life more attractive to their sons.

The Seal of Approval on Electric Living

At the top of the Statistics Page each week appears a chart showing the weekly production of electric energy. This is more than an illustration of a statistic. It is the public's seal of approval on electric living.

People don't buy electric energy. They buy its use. Use and purchase coincide. As they purchase more the white line on the chart keeps crawling steadily upward. The nine-billion-kilowatt-hour week is now commonplace. Not all of these kilowatt hours are going into homes. Some are going into commercial and industrial establishments because working electrically is just as important as living electrically. But it is the increased use of electricity in the home that is doing much to drive the output higher and higher.

Home air conditioning has done much to end the dip in output which prevailed for so many summers that it had long been traditional. The demand for electric house heating will slowly become apparent. Greater saturation of major appliances, such as automatic washers, clothes dryers, and ranges, will do much to increase the annual sales of electric energy.

So as you watch that curve going up to the 10-billion mark, past it, and still higher, think not of it as merely greater production of electric energy but as millions of Americans putting their approval on electric living.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Detroit Edison announces plans to install 300-Mw unit at River Rouge plant.

Offer of three Northwest utilities to advance planning funds to Army Engineers for John Day Dam was prompted by desire to see immediate start on the much-needed hydroelectric project.

EEI survey predicts December reserve of 19.3%. Manufacturers report record capacity additions are scheduled for next year.

Former TVA Chairman Gordon R. Clapp, now Deputy New York City Administrator, Robert Moses, vocal chairman of N. Y. State Power Authority, and Consolidated Edison Co of N. Y., became embroiled over power matters last week. Clapp, brought in to probe city's ailing transit power situation, issued his first report, a 41-page document. He criticized Con Edison and suggested, among other things, buying St. Lawrence Seaway power.

Said Clapp: "... There is little basis for believing that sale of the plants and purchase of power from an outside source would relieve the city capital budget of an amount equal to that required to modernize the plants . . . Past history of piecemeal offers from the Edison company to buy parts of city's properties lends strong support to inference that such offers have been made primarily to encourage public doubts about the wisdom for further capital fund expenditures on city's power plants and to stop the program without offering adequate, economical or safe substitute."

Said Harland C. Forbes, Con Edison's executive vp: "Con Edison has repeatedly made proposals for purchase of these plants only to have them rejected on the basis that estimates provided by city representatives have shown that by spending vast sums on modernization, city could at some time in future obtain power from its own plants at a cost lower than the price offered at present by Con Edison. Company still stands ready to purchase city's plants at a fair price. Con Edison has made reasonable proposals. Mr Clapp ought not to compare them to irresponsible estimates."

Said Moses: Clapp's proposal (to investigate possibility of buying St. Lawrence Seaway power) is a "fantastic scheme."

Clark Hill power issue is still up in the air. Georgia's former governor, Ellis Arnall, tells Electrical World "as far as the co-ops know, the Interior Department still is in the process of studying the Clark Hill issue." Georgia Power's Pres Harllee Branch, Jr, says his company is also still in the dark. Indications point to no action on the issue until December.

Off the Washington Wire . . . AEC receives 18 bids to build the package reactor for the Army Corps of Engineers. Evaluating bids will take six weeks.

FPC's September report shows electric revenues and income of large utilities totaled $553 million, 6.5% over 1953 . . . FPC authorizes Cities Service Gas to build line to supply natural gas to Kansas G&E's new Neosho generating plant . . . Lytle & Green, Sioux City, Iowa, is apparent low bidder for initial work on 72,000-kw Glendo, Wyoming, unit.

National Hells Canyon Association needs to generate more cash. It will pass the hat among public power supporters to raise the $19,000 it needs to complete its case before FPC against Idaho Power's proposed hydro project for the Snake River.

British Electrical Research Association is constructing $1.2-million laboratory at Leatherhead, Surrey, to investigate problems connected with Britain's growing domestic and industrial electricity consumption. Facilities will be included for network analysis, investigation of transformer design and high voltage surges, and work on materials. Site includes present terminal station of British Electrical Authority's 400-kv experimental cable line.

A. C. Monteith, Westinghouse vice president, says atom will account for less than 2% of power generated in 1963 . . . Con Edison's A. Bryan Marvin says (relative to atomic generation) "if the steam were completely free, it would amount to a reduction of less than 14%" in average N. Y. residential rate.

General Electric drops practice of suggesting store prices for major appliances, leaving price up to distributors . . . GE wins $11 million government order to supply eight 78,000-kw hydro generators for The Dalles Dam on Columbia River.

Pacific G&E applies to FPC for 69,000-kw, $17 million hydro project for Pit River, Shasta County, Calif. The two previous applications are now pending with FPC.

Dayton P&L and UWUA-CIO agree on one-year contract providing 8¢/hr wage increase . . . Utah P&L says it will throw open for public use the auditorium of its new Ogden office building . . . Ohio Power names Booth & Flinn, Pittsburgh, to build the new 120,000-kw steam unit at the Philo Plant. Unit will be first to utilize steam at 4,500 psi.

Executive Changes . . . Merritt A. Giles, general supervisor of operations of Pennsylvania Power, was made vice president . . . Dr Lawrence R. Hafstad resigned as director of AEC's Reactor Development Division to join Chase National Bank of N. Y. as atomic energy consultant effective Jan. 1.

Cisler tells stockholders . . .

WALKER L. CISLER

Detroit Edison Co will install world's largest unit (300 Mw) at River Rouge Plant

Detroit Edison Co will install the world's largest turbine-generator with a steam generator to match in its River Rouge Plant. Announcement of the purchase of the 300-Mw equipment was made by Pres Walker L. Cisler at the third annual stockholders information meeting held at Dearborn, Mich.

The River Rouge Plant, which is now under construction at a site five miles south of Detroit at the confluence of the Rouge and Detroit Rivers, will put its first 260-Mw unit on the line early in 1956 (EW, May 18, 1953, p 256). The second is scheduled for operation later that year and the 300-Mw unit for late in 1957. Total capacity then will be 820 Mw.

Cross Compound Unit . . . The turbine-generator will be supplied by Allis-Chalmers Manufacturing Co. It will be cross-compound, single reheat. Guaranteed capability will be 300-Mw with generator rated at 0.8 pf, 0.8 short circuit ratio, and 18,000 v. Load split is 163-Mw on a 3,600-rpm, hydrogen supercharged-cooled generator and 137-Mw on a 1,800-rpm conventionally cooled generator. Supercharged-cooling of the 3,600-rpm stator and rotor will result in a rotor forging diameter and length comparable to some in service today.

Single Reheat . . . The steam generator, rated at 2 million lb of steam per hr and fired with coal supplemented with blast furnace gas, will be supplied by the Foster Wheeler Corp. It will be natural circulation, two-furnace and single-reheat type. Six pulverizers, each rated at 23 tons of coal per hr, will be supplied by the Riley Stoker Co.

The throttle pressure for this unit will be 2,400 psig. This is a 400 psig increase over the first two River Rouge units. The increased thermal economy easily justifies the additional investment for steam generator and auxiliaries. No increase in primary (1,050F) and reheat (1,000F) temperature above the first two units is economically justifiable.

It is expected that seven extraction stages will be used. This is similar to the first two units but will result in a plant heat rate reduction of about 150 Btu/kwhr. The reduction is attained chiefly because of the thermal economy resulting from increased throttle pressure and use of 46-in. last-stage turbine blades in the exhaust end of the double-flow, low-pressure turbine. The expected plant heat rate at turbine capability and 1-in.-Hg back pressure is 8,750 Btu/kwhr.

Low Investment Cost . . . A strong factor in the selection of size for this unit was the economy resulting from lower investment cost per kilowatt compared with the first two.

This 300-Mw unit will carry about 10% of the expected Detroit Edison system load when the unit is installed and a lesser percentage of the interconnected system so that the size of this unit is not large in comparison. No additional reserve in terms of percentage of system load is anticipated.

The steam-generator and all auxiliaries will be designed for a turbine-generator capability of 320 Mw. The first two units are rated 260 Mw each. Unit No. 1 turbine-generator is being manufactured by the General Electric Co and the second unit by the Westinghouse Electric Corp. First steam-generator will be supplied by Babcock & Wilcox Co and the second by Combustion Engineering, Inc.

Private Aid for John Day?

Three Northwest firms offer Army Engineers $350,000 planning funds to permit early start on 1,105,000-kw hydro project

A year saved in construction time on a power project in the Pacific Northwest can mean the difference between enough power or a shortage in the region by the early 1960's.

This fact has prompted three investor-owned utilities to offer $350,000 to the Army Corps of Engineers to permit an immediate start on field exploration and preliminary design for the John Day Dam and powerhouse on the Columbia River. A start now on the multipurpose project, deemed the most promising major undeveloped site on the lower Columbia, would take advantage of the low water winter months at hand.

Pacific Power & Light Co, Portland General Electric Co, and Washington Water Power Co, who have made the offer, explain that it has "no strings attached." The offer is not concerned with whether the site ultimately is developed by the U. S., by an investor-owned utility, or by a partnership. Should Congress later appropriate funds for the dam, the companies would be reimbursed. But they specifically state in the offer that they expect no interest on the money and fully realize that the project may never be built.

Power Shortage Feared . . . Presidents Paul B. McKee of Pacific P&L and James H. Polhemus of Portland GE, said the offer was induced by the "grave concern" the three firms felt over the "pending power shortage in the Pacific Northwest which will develop early in the 1960's if no new large projects are brought into operation before 1963."

In his letter to Col J. U. Moorhead, Portland district Army engineer, Polhemus said the work should be done this winter, otherwise "initiation of construction may be delayed at least a year no matter how the project may be undertaken." He said a check will be issued to the U. S. treasurer upon notice of approval by the Secretary of the Army. "As the best working season is fast approaching, your expeditious handling of this matter will be appreciated," Polhemus concluded.

A joint statement by the companies noted that "along with several associates" the firms have been endeavoring to get John Day started under a partnership arrangement whereby the "local electric systems and industries" would finance the power costs which would amount to about half the estimated $325 million cost.

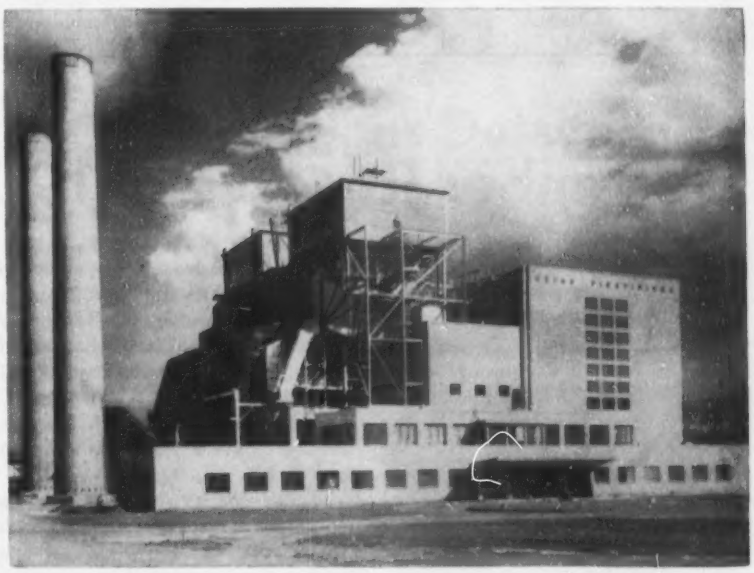
No Precedent Exists . . . The Corps of Engineers has not yet decided whether to accept the offer although they can do so legally under a 1925 law. Veteran engineer officials in Washington said they could not remember a precedent for beginning a project of the magnitude of John Day with such financing. Only in a few cases, such as a flood control project a few years ago at Battle Creek, Mich., where the amount was small, has the corps accepted outside planning funds.

Since the statute authorizing the John Day project calls for federal construction, rather than the "partnership" approach, the Budget Bureau last year refused to ask for appropriations to get the thing off the ground. Irate Senators succeeded in getting an $800,000 appropriations rider through their side of Congress, but the House eliminated this on the basis of the President's lack of endorsement.

The new Democratic-controlled Congress has a clean-cut opening to vote such funds, but it is doubtful that Eisenhower will change his tactics and ask for money in the 1955 budget.

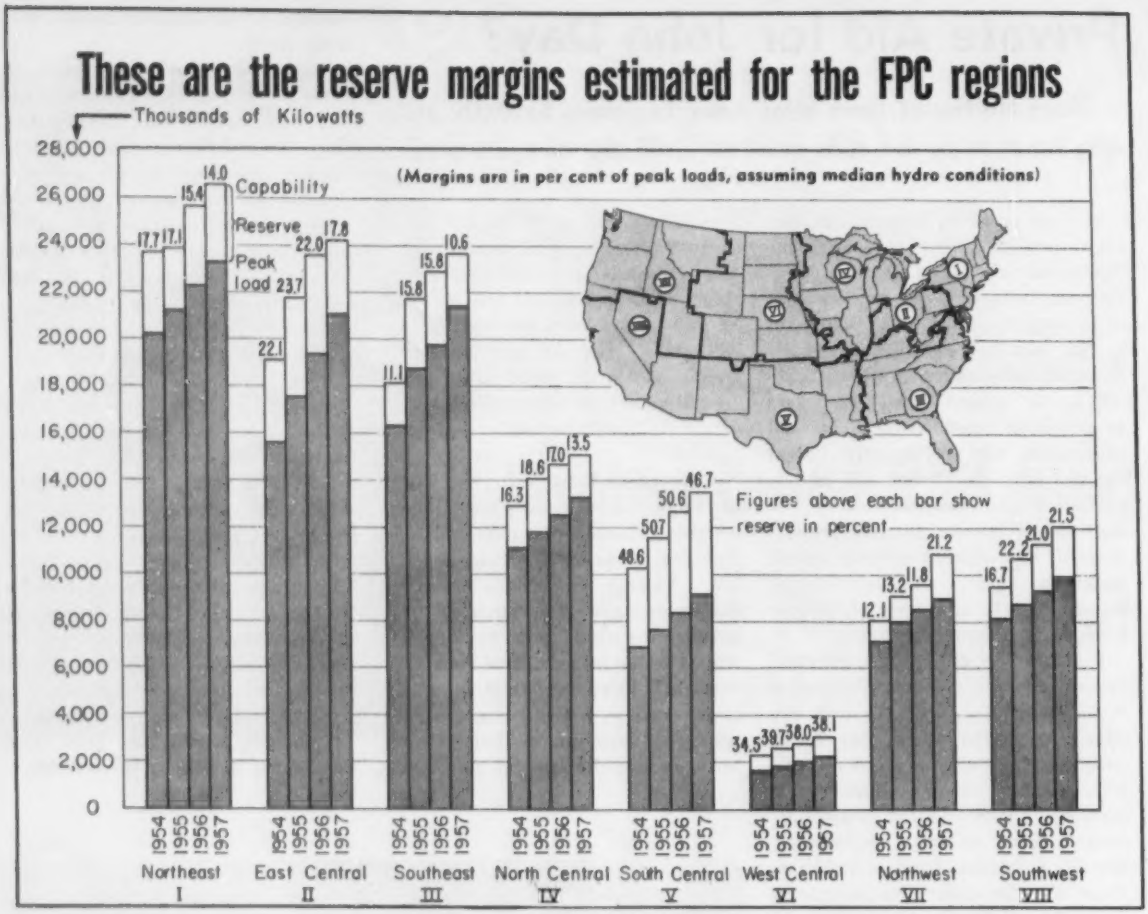
This would put the engineers in the middle, should they want to take advantage of the utilities' offer. They could expect support from Congress but would have trouble persuading Defense Secretary Charles Wilson and Budget Director Rowland Hughes agreeing to accept the money and their request for additional funds to complete studies and construction.

Upstream from Dalles Dam, John Day would develop 1,105,000 kw.



Brazil's Largest Steam Plant

Largest steam plant ever built in Brazil was officially inaugurated earlier this month. Known as Piratininga Plant, the new unit (shown above) is located on the outskirts of Sao Paulo. It was built for Sao Paulo Light & Power Co, Ltd, by Brazilian Traction Light & Power Co, Ltd. The semi-outdoor type plant consists of two General Electric Co turbine generators, each with a capability of 100,000 kw. Plant was designed by Stone & Webster Engineering Corp and built by Stone & Webster Construction Co.



December Reserve of 19.3% Predicted

Edison Electric Institute has forecast that electric power suppliers in the United States will have a reserve of 19.3% at the end of December of this year. This figure coincides almost exactly with the December reserve of 19.2% predicted by the institute this spring (EW, May 31, p 56).

The latest reserve estimates were disclosed this week as EEI released its 16th Semi-Annual Electric Power Survey.

The December 1954 reserve margin is based on a capability of 104,154,000 kw and peak load of 87,322,000 kw. In 1953 reserve was 17.6%. Capability stood at 92,336,000 kw and peak load at 78,531,000 kw.

The EEI report estimates that reserve will increase still further in 1955 but then drop off slightly in 1956 and 1957. A reserve of 21.5% is seen for 1955 based on a capability of 116,537,000 kw and peak load of 95,893,000 kw. For 1956 a drop in reserve to 20.5% is predicted with capability at 123,418,000 kw and peak load at 102,452,000 kw. And in 1957 estimated reserve is 18.5% with capability at 129,297,000 kw and peak load at 109,113,000 kw.

Figures for 1957 throughout the report are tentative, said EEI, since scheduling of capability for that year has not been completed.

EEI estimates assume median hydro conditions and should these conditions prevail no section of the country would experience power shortages over the next three years.

But, as in past year, in the event of adverse hydro conditions the western division of Federal Power Commission Region VII (Northwest) would be faced with deficits for the next few years. Deficit for 1954 would be 1.9%, for 1955, 2.8%; and for 1956, 2.2%. But by 1957 the situation would improve, according to preliminary estimates, so the division would have a narrow margin of 1.6%. Despite these deficits, the eastern division of Region VII would have no trouble in meeting loads in bad water conditions, thus giving the region as a whole positive reserve margin.

Continuing a pattern established several years back, peak load for Region V (South Central) will occur during the summer, the EEI report indicates. Although December reserve is listed as 48.6% for 1954, 50.7% for 1955, 50.6% for 1956, and 46.7% for 1957, summer reserves are less than half these percentages. Mar-

gins for the summer months are estimated as follows: 1954, 17.6%; 1955, 20.0%; 1956, 20.7%; and 1957, 16.9%.

Biggest gains in energy output for 1954 over 1953 were made by Region III (Southeast)—17.7% and Region V (South Central)—11.6%. All other regions showed increases of less than 10%. Smallest gain was recorded in the Region I (Northeast)—2.6%. Estimated increases for 1955 over 1954 showed the Region III out front again with a gain of 23.3%. Region II (East Central) ranked second with 14.8%. Gains of more than 10% were indicated for Region V, Region VI, (West Central) and Region VII (Northwest).

Pepco Plans to Scuttle Its 'Washington Plan'

Potomac Electric Power Co is trying to get out from under the so-called "Washington Plan."

In hearings before the District of Columbia Public Utilities Commission last week, Pepco: (1) Presented its case for a $5,785,000 increase in rates, based on a 6¼% return on a year-end rate base, computed on 1954 operations, rather than the 5½% allowable return, on an average weighted rate base, now in effect, and (2) asked that the sliding scale method of meeting the allowable return be abandoned.

Pepco has operated under a sliding scale plan since 1925. The plan is designed to provide an annual adjustment if the basic rate of return is greater or lower than that allowed by the commission. As modified, this plan now provides for a deferred credit account into which is put one-half of any excess. Funds for the deferred credit account are deducted from income.

Pepco said its earnings in 1949 and 1952 were at least the permitted 5½%. But in 1948, 1950, 1951, 1953, and 1954 (anticipated) rates have been below this allowable. This has resulted, the company said, in Pepco's receiving a cumulative return of $2.5 million less than that permitted by the commission.

The company has testified that the plan is unworkable. It asked the plan be discontinued as of Dec. 31, but PUC recessed hearings until Jan. 4.

MVGC Financing Plan . . .

. . . for issuance of 55,000 shares of common stock to Middle South Utilities and Southern Co will be heard by SEC Dec. 7

Adherents of the Dixon-Yates contract returned to a business-as-usual routine last week but opponents are still vowing they will continue the fight.

These developments marked the first quiet week since the political storm broke last spring over the Atomic Energy Commission's proposal to buy private power in the Tennessee Valley Authority area:

- The Securities and Exchange Commission set Dec. 7 as the date for a hearing on the Dixon-Yates firm's financing proposal. That company—Mississippi Valley Generating Co—plans to issue 55,000 shares of common stock to Middle South Utilities, Inc, the holding company headed by Edgar H. Dixon, and the Southern Co, another holding company whose Board Chairman is E. A. Yates. SEC said Dec. 6 is the deadline for filing of petitions to intervene. Several public power groups have promised to fight the proposal.
- Tennessee Valley Authority officials prepared for another meeting with AEC staff members to iron out differences between those agencies on a follow-up agreement to implement the Dixon-Yates contract. Two of the three TVA directors refused to go along with the Dixon-Yates arrangement for a long time, but they are now ready to sign whenever their subordinates come up with a satisfactory cost allocation formula.

TVA-AEC Meeting Scheduled . . . TVA-AEC conferences were held up while AEC went before the Joint Committee on Atomic Energy to obtain approval of the basic Dixon-Yates contract. Now that Republicans on the Joint Committee have outvoted Democrats on approval, permitting signing of the contract, plans for reopening of TVA-AEC talks are being made.

A TVA-AEC meeting in early December will seek agreement on TVA's share of the cost of Dixon-Yates power.

AEC Nominations Delayed

The fight over the Dixon-Yates contract has stalled until January, at least, Senate confirmation of the nominations of Drs Willard F. Libby and John von Neumann as Atomic Energy Commissioners.

Senator Estes Kefauver (D-Tenn.), a vigorous foe of Dixon-Yates and a TVA advocate, stymied the Administration's move for confirmation at the fall special session of Congress. The Joint Committee on Atomic Energy met briefly on the nominations, but Kefauver announced he would fight their confirmation until Congress had a chance to examine the views of the candidates on Dixon-Yates. His opposition was caused by Libby's approval of the Dixon-Yates contract.

The Joint Committee recessed, and the feeling was in Washington that it would not meet again on the subject until the new Congress comes in. Kefauver's success in stalling the hearings was based on an announcement by Senate Majority Leader Lyndon Johnson (D-Tex.) that his party would not take up until next session any nominations considered controversial.

DR. WILLARD F. LIBBY

Trade Decision Due

Presidential order may come soon on the administration of the Buy American Act

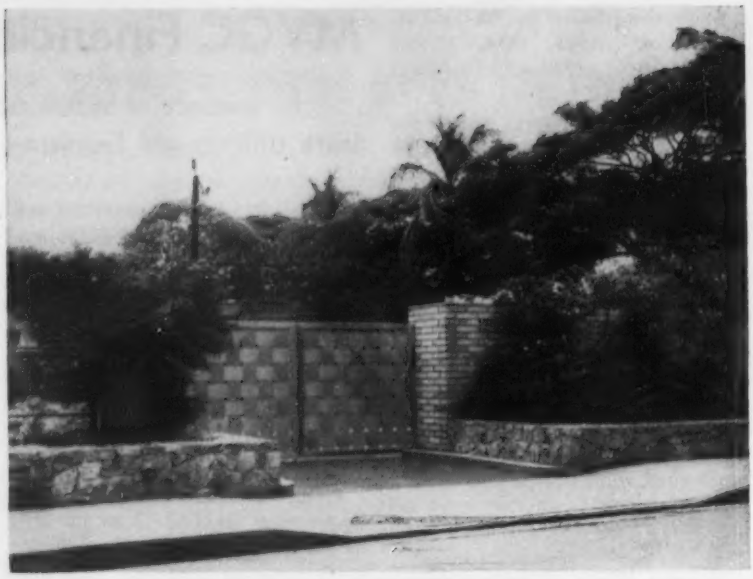
The long-awaited Presidential order to liberalize administration of the Buy American Act to give foreign bidders a better chance of winning U. S. government contracts may be in the offing.

U. S. officials close to the protracted inter-agency negotiations over revision of Buy American procedures report that the main problem still to be solved is how big a price preference to give American bidders.

Recent Awards to Foreign Bidders . . . A number of contracts have been granted recently to foreign bidders recently whose bids were only some 12% under the lowest domestic offers. This has led to speculation that the preferential price differential may be set officially at 12%. Traditionally U. S. bidders on government contracts have enjoyed a 25% preferential price margin over their foreign competitors. No specific margin of protection for domestic bidders was written into the Buy American Act of 1933—the basic law under which preferential buying by the government is carried out.

The final decision on Buy American policy hasn't been taken yet by the Administration. It's still not certain that Buy American rules will in fact be liberalized let alone how much. Partisans of a freer trade policy within the Administration still are pushing for wiping out Buy American preferences altogether except where the national security or unemployment may require the government to throw a contract to a domestic firm. Protectionist-minded officials—and Congressmen too—are fighting to push Buy American preferences back to 25%.

Liberalization Is Expected . . . Odds are that some liberalization of Buy American rules will result eventually from this struggle. The President committed the Administration to relax the rules in his foreign economic policy speech last March. He called Buy American preferences "improper," "unbusinesslike," and "unfair to the taxpayer." This will be a difficult commitment for him to back away from completely.



It's a Substation—Hawaiian Style

Hawaiian Electric Co in Honolulu, Hawaii, has a "good neighbor program" which calls for keeping its residential district substations as attractive as possible. The Honolulu substation pictured above is just one of the utility's substations which got a beauty treatment Hawaiian style.

In practice the program means that when HECO—which has perhaps 200 substations—is about to build a new residential area station it calls in a landscape gardener to handle the camouflage job. Objective is to choose plants which will be attractive, fit in with the neighborhood, cover and hide the transformer (which is painted green) as much as possible, and take the least maintenance in particular climatic conditions. Honolulu's rainfall varies within very short distances. Cost normally runs from $500 to $1,500 a station.

Keeping up the stations is done by two maintenance crews of four or five men each which move from substation to substation.

Advance Substation Plans Required in Nashville

Nashville real estate developers will have to make provision in the future for Nashville Electric Service substations in residential developments.

W. A. Pitts, city-county planning director, said plans for new residential developments will go to the electric service for its study henceforth before they are approved by the county planning commission. The new policy was adopted by the commission at a meeting this month. It was requested by NES.

Nashville Electric Service will hold no veto power over the development of a new residential area, Pitts said, but the service will be consulted to determine if it can serve the area adequately before the developer gets a green light on his development.

The commission will process new developments through NES in much the same manner applications are processed through the county health department on sewage requirements.

The new policy comes as a result of the failure of real estate developers in the past to consider properly electricity as one of the essential utilities in a new residential area. NES has been beset with difficulties in locating substations in new areas:

- Real estate developers sometimes refuse to sell NES sites for substations.
- NES has been forced to go through tedious and controversial zoning appeals cases in order to install substations in new areas. In cases where NES has not been able to purchase property in the new areas, the service has had to shop around to find the best available site at the point nearest the load center.

REA Formula

Nelsen will ask Congress to eliminate state allotment formula for distributing loans

Rural Electrification Administration is now convinced that complete elimination of the state allotment formula for REA loans is the best way to distribute capital to needy co-ops.

For a while, Administrator Ancher Nelsen wasn't sure whether he wanted the formula killed outright, or whether he should ask Congress to adjust it in some way to provide flexibility to meet heavy generation and transmission loan needs and the requirements of older systems becoming obsolete for their growing loads.

At a recent Denver co-op meeting sponsored by National Rural Electric Cooperative Association, Nelsen advanced the idea of putting flexibility into the loan system, and NRECA passed a resolution favoring abolition of the formula (EW, Nov. 8, p 5.).

Loans According to the Need . . . Nelsen has announced that he would ask Congress to abolish the formula completely. He said the formula is not needed because of established policy of making rural electrification loans where the need exists.

The formula provides that one-half of each year's new funds be allotted for use among states on the basis of the number of unelectrified farms in a state compared with the number unelectrified in the whole country, and that not more than 10% of the remaining one-half of new money may be loaned in any one state in a year.

Colorado Example Cited . . . The choice of Denver as the place to tell of REA's plans to ask for loosening up of the formula was not accidental. In the Colorado area alone, co-op plans to build new G&T facilities and integrate them with existing systems—some of them run by private utilities—would demand more than $40 million in the long run. Under the formula's restrictions, Colorado comes in for less than $20 million in loan money this year.

It's not as complete a shut-out as would appear on the surface, but, without more flexibility, REA might be faced with some pressing time and money factors. In the Colorado situation, some of the planned facilities lap over into neighboring states, thereby adding to the loan pool available to this area. Furthermore, since the plans are in various stages—some are represented by firm applications for REA loans; some are still only in the discussion stage—all loans would not be needed at once, giving REA a time factor which could work out favorably should the applications lap over into the next fiscal year. With the coming of July 1, this year's allotment for a single state would be bolstered by loan funds allotted for 1955.

Loan Demand Growing . . . Nevertheless, with the growing demand for large G&T loans, and the rapid obsolescence of many REA-financed systems, the agency is faced with a situation it thinks it can no longer handle easily under the old law. Pressure for money to finance heavying-up of existing lines is expected to get stronger as time passes, and REA wants to be able to meet justifiable demands. Officials reported that about one-fourth of last year's loan money went to heavy up existing transmission and distribution systems.

To get a better idea of how big the demand may be for REA loans in the next few years, the agency recently sent out questionnaires asking co-ops to estimate their loads for five years. These were due at REA on Nov. 15, but, so far, no tabulations had been made.

Central Valley Sale Undecided After Talks

California officials have met with the Interior Department in Washington to talk price on their plan to buy the entire Central Valley Project from the federal government.

Representatives of the California Water Project Authority met in the office of Assistant Interior Secretary Fred G. Aandahl to present their offer to purchase the $529 million project. Pending further talks, "no sale" was still tagged onto the project.

Interior has proposed a cost allocation—based on the new cost allocation plan—of $54 million for nonreimbursable flood control and fish and wildlife expenditures, and $474.9 million for reimbursable power and irrigation expenditures. The California officials failed to agree to these figures, proposing:

- $104 million as nonreimbursable.
- Establishment in the U. S. Treasury of a Central Valley Project fund equal to the purchase price the state would pay, the money to be spent only as Congress appropriates from it for use in the CVA Project. This fund could be used for no other purpose.

Aandahl called this a way of establishing a "supplementary reclamation fund earmarked for California," and said he could see no reason why Interior should agree to it.

The group scheduled another meeting, and both agreed to study the matter further.

MEETINGS CALENDAR

Complete listing of meetings appears in last issue of each month.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Annual Meeting, Statler Hotel, New York, Nov. 28-Dec. 3; Spring Meeting, Lord Baltimore Hotel, Baltimore, Md., April 18-20, 1955.

FIRST INTERNATIONAL AUTOMATION EXPOSITION

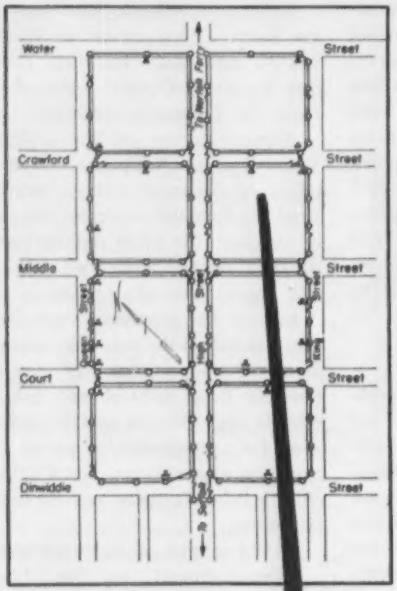
244th Regiment Armory, New York, Nov. 29-Dec. 2.

EDISON ELECTRIC INSTITUTE

Wiring and Specifications Committee, St. Louis, Nov. 29-30; Prime Movers Committee, Astor Hotel, New York, Nov. 29-30; Commercial Electric Space Heating and Air Conditioning Committee, Cleveland, Dec. 2-3; Street Lighting Committee, Boston, Dec. 7-8; Commercial Cooking and Water Heating Committee, Jefferson Hilton Hotel, St. Louis, Dec. 8-10; Industrial Relations Committee, EEI Headquarters, New York, Dec. 16; Industrial Relations Committee, EEI Headquarters, New York, Jan. 20; Prime Movers Committee, Grand Hotel, Mobile, Ala., Jan. 31-Feb. 1; Home Service Committee, Washington, D. C., Feb. 4-5; Accident Prevention Committee, Shoreham Hotel, Washington, D. C., Feb. 9-10; Transmission and Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 10-11; Industrial Relations Committee in conjunction with AGA at AMA Mid-Winter Personnel Conference, Palmer House, Chicago, Feb. 14; Electrical Equipment Committee, Deshler Hilton Hotel, Columbus, Ohio, Feb. 14-15; Commercial Electric Space Heating and Air Conditioning Committee, St. Louis, Feb. 17-18; Residential Promotion Committee, New York, Feb. 17-18; Accounting Conference, Planning, Edgewater Beach Hotel, Chicago, Feb. 17-18; 1st Street Tree and Utility Conference, co-sponsored with EEI Transmission and Distribution Committee and Street Lighting Committee of Illuminaitng Engineering Society, Wade Park Manor, Cleveland, March 3-5; Sales Conference, Edgewater Beach Hotel, Chicago, March 28-31; Annual Convention, Statler-Biltmore Hotels, Los Angeles, June 13-16, 1955.

(*Continued on page* 138)

In Portsmouth, Va . . .



CARLTON M. STALLINGS, Assistant Engineer, Virginia Electric & Power Co, Richmond, Va.

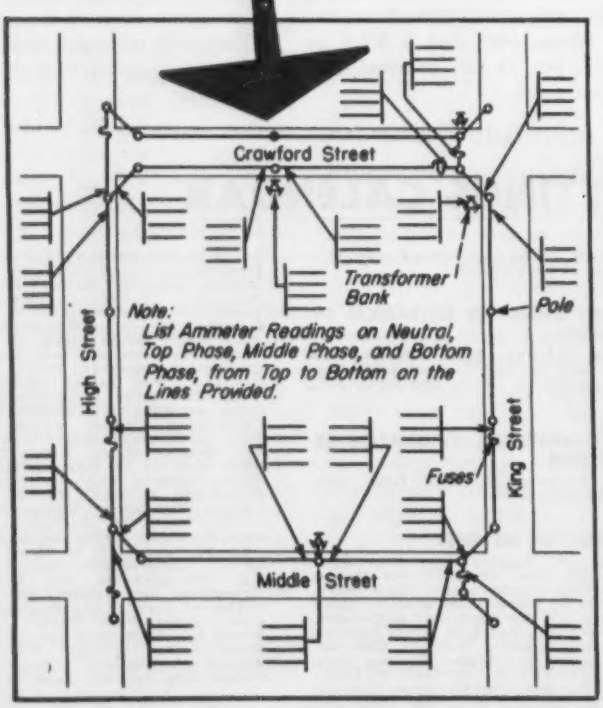
Use of banked secondaries by the Virginia Electric & Power Co in Portsmouth has saved about 30% in installed transformer capacity and 32% in secondary copper over an equivalent radial secondary system. Moreover it has allowed all transformer installations to be made off the main business street leaving it uncluttered by transformers and primary circuits.

Another installation of banked secondaries in Richmond resulted in a cost saving of about 25% over an equivalent radial secondary system.

After 18 years' experience with such systems, VEPCO believes that banked secondaries are the economic solution to the problem of poor voltage regulation and lamp flicker in areas where load density is not great enough to justify the expense of underground or overhead networks but where load is more dense than in rural or scattered residential areas.

When used under suitable loading conditions, secondary banking improves the quality and reliability of service with less transformer capacity and smaller secondary

Banked Secondaries



MAIN BUSINESS STREET is uncluttered with the transformers and the primary circuits

copper than would be required on a radial system. The advantages of secondary banking may be obtained most economically by using conventional transformers with fuses connected in the secondary mains. But greater service reliability may be realized through the use of banking transformers with self-contained primary protective links and secondary circuit breakers.

Secondaries may be banked by paralleling transformers along a line and leaving the ends of the secondary open (line banking), or secondary may form a closed loop (loop banking). Banked secondaries may be 3-wire, 120/240-v, single-phase, or 4-wire, 120/208-v, 3-phase wye.

The fast growing, heavily loaded commercial area of Portsmouth has been served with a 3-phase, 4-wire, 120/208-v, wye-connected, banked secondary distribution system since 1935. The banked secondary area is fed by four 2.4-kv delta primary feeders, individually regulated and emanating from a common bus at Middle Street Substation. The distribution transformers in the area are all conventional transformers. Some are 3-phase, pole-mounted, stack transformers, and some are conventional single-phase units in 3-phase banks.

Transformer primaries are fused in the same manner as in radial systems in accordance with VEPCO's Standard Construction Manual. The secondary is generally 4/0 to 500 MCM weatherproof copper, installed on bracket clevises or secondary racks, and fused in the secondary mains, between banks, with 200-N and 300-N amp secondary fuse links.

In order to make secondary fusing simple, a rule of thumb has been adopted for the use of servicemen.

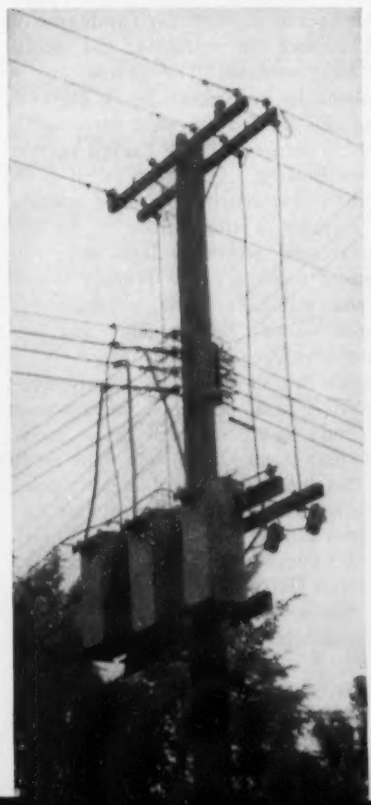
1. If the secondary conductor is smaller than 4/0 and the transformer banks feeding that secondary are less than 150 kva, 200-N amp secondary fuse links are used.

2. If the secondary conductor is 4/0 or larger and the transformer banks feeding that secondary are 150 kva or larger, 300-N amp secondary fuse links are used.

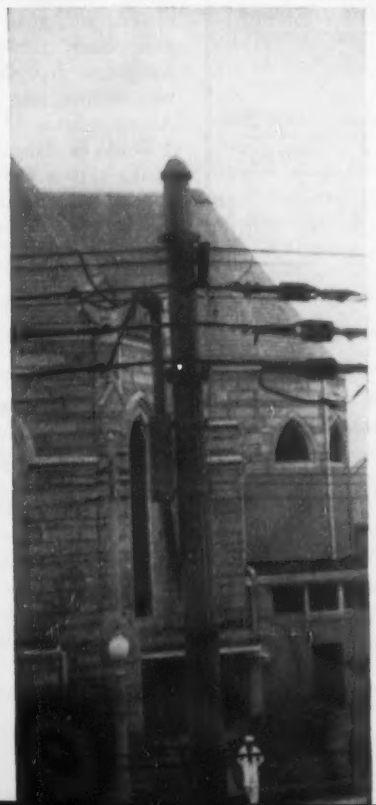
High Street, main business thoroughfare, divides the banked area. No secondaries cross High Street, but secondaries extend along either side of the 100-ft wide roadway from the Norfolk Ferry slip on the Elizabeth River (Water Street) west for eight blocks through the business district and encircle each block north and south of High Street for one block. The total area in which the secondaries are banked is about 16 square blocks. Trans-

Save 30% in Transformers

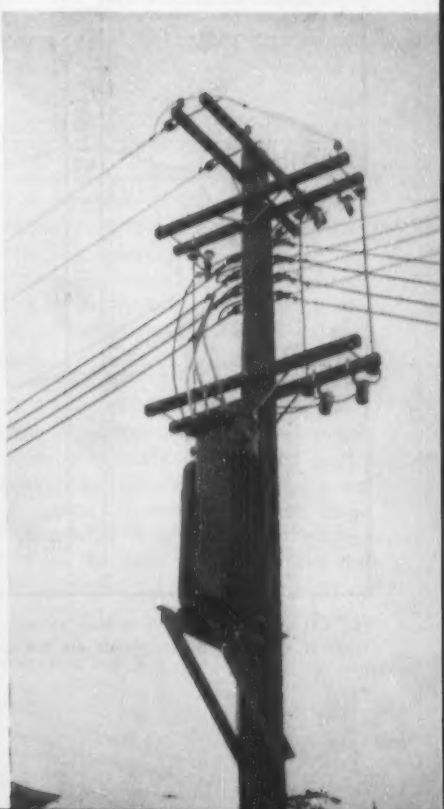
THREE-PHASE BANK of single-phase units serves weatherproof copper secondaries



SECONDARY FUSES are installed where checks show minimum load current exchange



FUSE CUTOUTS in secondary mains between banks have 200-N-Amp secondary fuse links



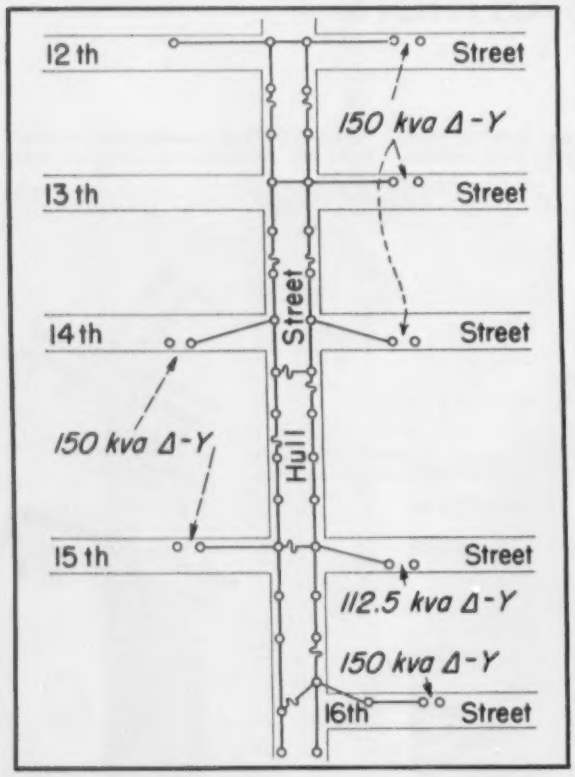
former banks are placed one or two spans from High Street and along King and Queen Streets, and secondaries feed in several directions from the transformers.

Secondary fuse links are installed at a point in the secondary mains where load checks indicate a minimum of load current exchange takes place. Generally the secondary is deadended on bracket clevises at this low load point, or it is broken through a strain insulator, and a secondary fuse link is connected between the two sections of secondary main with split bolt connectors. Secondary fuses connected across strain insulators are most commonly used.

The fusible element of these secondary fuses is enclosed in a length of horn fibre tubing, and tails about 12 in. long are furnished for connecting the link. No fuse cutout is used. When the fuse is blown by a load unbalance (a secondary fuse has never been known to blow from a fault), a spring, normally under compression within the fuse tube, is released and, acting as a target, indicates that the fuse is blown.

Blown fuses are located through calls from customers who note an increase in lamp flicker or reduced on-peak voltage. Blown fuses are generally replaced by first jumping the strain insulator with a load-pick-up jumper, then the new fuse is not required to pick up the load or the load unbalance.

Cascading . . . There has never been a case of cascading (disconnection of some or all of the good transformers in a bank following a transformer or secondary fault) in the Portsmouth system. If a transformer primary fuse is blown, the secondary fed by that transformer is isolated by the secondary fuses. Fuses installed at the low load point in the secondary mains as in Portsmouth, rather than in the transformer secondary leads, make the possibility of cascading negligible. A further reduction of the possibility of cascading may be realized by the use of specially designed banking transformers which incorporate two secondary breakers co-ordinated with a primary protective link.



SKETCH used by VEPCO servicemen to record load check ammeter readings when voltage complaints are not traceable to blown fuses

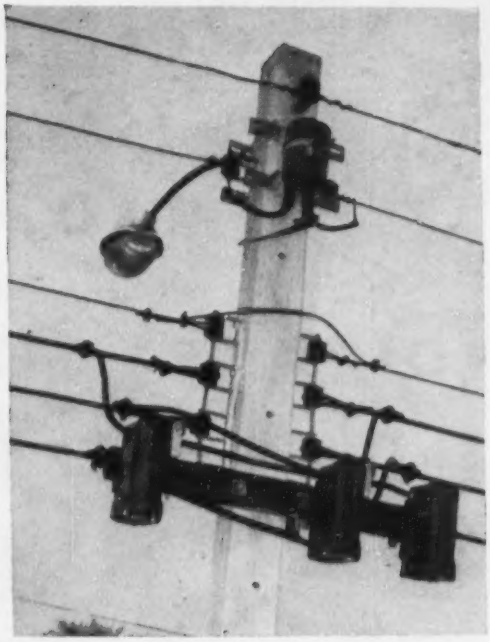
Air Conditioning Loads . . . Peak load season is the summer with its commercial air conditioning load. Before 1935, voltage regulation, as high as 10% to 15%, was becoming intolerable, and lamp flicker was becoming more noticeable as air conditioner motor loads increased. Secondary banking reduced complaints of poor regulation, low voltage, and lamp flicker to an almost negligible minimum, correcting regulation to about 4%.

Voltage Complaints . . . When voltage complaints occur in the banked area, servicemen look first for blown secondary fuses on either side of the low voltage condition. In many cases replacement of a fuse rectifies the trouble. However, if a blown fuse is not the cause, a diagram of the area in trouble is made. The diagram with load check points indicated is given to a serviceman along with a clip-on ammeter, and a check is made of secondary currents during peak load.

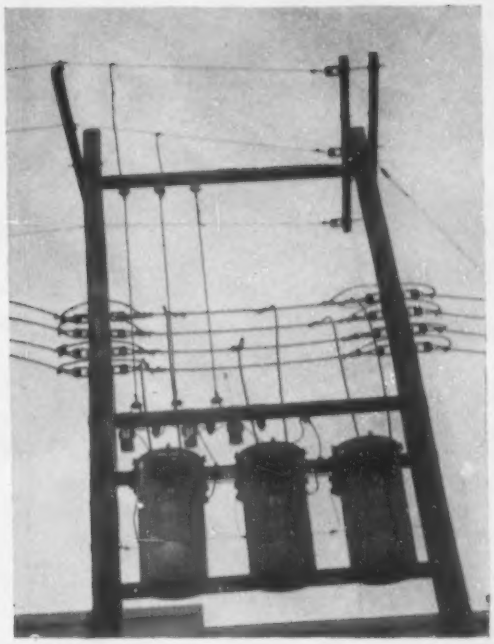
An unbalance of load currents may be found to be causing the voltage trouble, and a relocation of transformers nearer the heavy load may clear up the difficulty. Or, the need for increased capacity may be indicated, in which case a new bank of transformers is merely paralleled with the existing secondary. As transformers were located originally by estimating loads, it is seldom necessary to relocate them.

Safety Considerations . . . Secondary banking in the commercial area gives Portsmouth most of the advantages of a secondary network without the expense of the special equipment necessary for a network. The banked area is well defined and isolated in Portsmouth for a purpose. As other areas of the city are fed by radial secondaries, it would be dangerous to personnel if the banked portion of the system were not isolated. A lineman might think he was working on the radial system, and after opening the primary fuses, consider a transformer to be deenergized. If the transformer secondary leads were still connected to the banked secondary, the primary would be energized. Safety rules prohibit removing a transformer cover without first disconnecting both primary and secondary leads, but men have been known to forget.

Because of the increase in transformer capacity requirements in the downtown Portsmouth area, underground vaults are now being built to accommodate larger transformers than could be pole mounted. Already some areas are unsightly because there are transformers on every pole. The new vaults will be fed from radial 11-kv primary circuits, and the secondaries will be tied together in an overhead secondary network temporarily. Gradually banked secondaries in Portsmouth will be replaced by an underground network, but they will have served their purpose satisfactorily and economically.



BANKED SECONDARY LAYOUT in heavily loaded commercial area of Richmond not convenient to the underground network



TRANSFORMER BANKS are installed along the side streets and are fed from a single 2.4-kv primary. All banks are 150 kva

Richmond System . . . Other districts of VEPCO operate banked secondary systems but on a smaller scale. Richmond District operates a line bank of 3-phase, 4-wire, 120/208-v, wye secondaries in the southeastern section of Richmond, utilizing conventional transformers and 5-kv, 200-amp fuse cutouts, with 200-N amp fuse links in the secondary mains. The secondaries form a line bank along Hull Street from 12th to 17th Streets. Transformers in 150-kva banks, installed along streets just off Hull, are fed from a single 2.4-kv primary. This small, isolated banked secondary system serves the same purpose as the larger Portsmouth system.

Single-Phase Banking . . . There have been, in the past ten years, varying degrees of single-phase secondary banking in the Richmond District, made necessary by a scarcity of materials during the war. Experience with the system has not been satisfactory. No clearly designated area was selected for banking secondaries; they were banked when necessary to correct voltage regulation or eliminate lamp flicker. Usually these secondaries formed line banks which are less satisfactory than loop banks because voltage drop on the ends of radial secondary feeders beyond the two transformers on either end of the line bank may become excessive. Secondary banks were intermingled with radial secondaries; so a lineman was easily confused by the combination in a given location.

Cascading was common, and many manhours were required to patrol secondaries, locate blown fuses, and keep the system in operation. In some locations CSP transformers were banked with conventional transformers, and no fuses were installed in the secondary mains. If the CSP transformer happened to open its secondary breakers from overload or a transformer fault, the conventional transformer promptly burned up, and in many cases cascading began. Some secondary fuses were used. These often failed to indicate that they were blown, causing a loss of time in correcting voltage complaints and restoring service.

Single-phase secondary banking would have proved satisfactory in Richmond District had it not been installed under emergency conditions. However, line foremen now have standing orders to remove all secondary banking fuses found in the district and to report their location to the engineering department so that voltage and load checks may be made in the area.

Small Municipal System . . . Since 1947, Franklin, a small municipality served wholesale in VEPCO's Norfolk district, has had in operation a single-phase banked secondary system throughout 90% of the town. In 1947, many voltage regulation problems confronted the electrical supervisor. The distribution system was composed of small primary and secondary conductors, and load was growing at a rate of about 15% per year on the system. It was impossible to correct existing voltage conditions by the installation of primary regulators alone; for most of the losses were occurring in the secondary system, and it was economically impossible to rebuild the town's secondary system.

The electrical supervisor purchased several transformers designed with secondary specifically for banking applications and began to loop-bank his secondaries in a given area. Results were so satisfactory that he now uses loop-banked single-phase secondaries over most of his system, and radial secondaries are the exception rather than the rule. The few 3-phase customers are served from separate banks of conventional transformers. In the six years that Franklin has been operating a system of banked secondaries, no primary protective link has ever blown.

Cubatao Plant among first in Americas to employ HP tunnel-laid, oil-filled . . .

230-Kv Pipe-type Cable is Link in Sao

S. T. FRANKS, Canadian-Brazilian Services, Ltd., Toronto, Canada

Power from the Cubatao underground power station in Brazil will be transmitted from unit transformers by 230-kv, high-pressure, oil-filled, pipe-type cables through a 1,500-ft tunnel to an outdoor switchyard. From thence, Sao Paulo's growing load will be supplied over 230-kv transmission circuits.

In Brazil power and other utility services are provided by operating subsidiaries of the Canadian corporation, Brazilian Traction, Light & Power Co, Ltd. in an area in the Southeast. This area, though small, contains 50% of the installed generating capacity of the whole country, and produces more than 60% of the electrical energy consumed in Brazil.

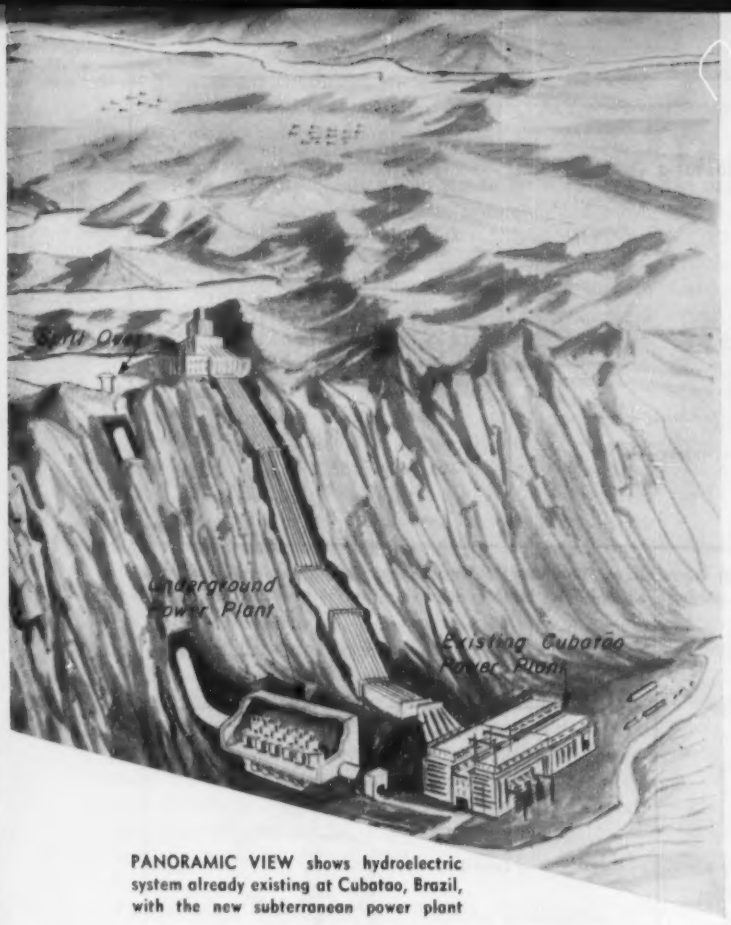
One subsidiary, the Sao Paulo Light & Power Co, Ltd, provides electrical energy for Sao Paulo and environs. Its generating facilities are hydroelectric with the exception of the steam plant now under construction at Piratininga.

The new underground plant, second of its type undertaken by Brazilian Traction subsidiaries, appeared desirable after construction of a 230-kv transmission line from the terminal of the line from Rio to Pirituba Receiver Station west of Sao Paulo. The numerous existing transmission lines on the Sao Paulo system are 88 kv, but a study in 1950 showed the desirability of superimposing on this system a 230-kv system.

Hydraulic System . . . The underground plant will operate from the same hydraulic system as the existing Cubatao above-ground plant. The run-off of small rivers is impounded behind dams and lifted by pumping plants to moderate head in the Billings reservoir. Water then flows through a control structure to the Pedras regulating reservoir at a nominal elevation of 727.5 meters (2,385.41 ft).

When the plant is completed, water will drop through a steel-lined pressure shaft at a 42-deg angle and then through a horizontal section to the powerhouse, all carved in the solid rock. After passing through turbines at a 10-meter (32.81-ft) elevation, the water will be discharged through a tunnel to the foot of the hill to follow an old water course.

Present plans call for four vertical impulse-type turbines directly connected to generators, each having a rated capacity of 65,000 kw. In the unit generation scheme one turbine, one generator, one transformer, and one cable



PANORAMIC VIEW shows hydroelectric system already existing at Cubatao, Brazil, with the new subterranean power plant

Paulo Supply

line will form an individual unit. The transformers will be located in masonry enclosures close to the generators. Power will be transmitted to the switching structure through 230-kv high-pressure, oil-filled, pipe-type cables.

Selection of Voltage . . . In the initial stages, three voltages were considered for the cables: generating voltage at 13.8 kv, and transmission voltages at either 138 or 230 kv. The relative costs of cable systems with regard to voltage are shown in Fig 1, which includes only the cost of cables with accessories and the tunnels. It was found that the 230-kv value actually has a greater capability because of the conductor size chosen. The 138-kv alternative for the cables was eliminated when it was decided that 230 kv would be used for the Sao Paulo system. This narrowed the choice to either 13.8 or 230 kv.

Anticipating a North American demand for 230-kv cables, the Association of Edison Illuminating Companies had incorporated this voltage in its specifications for oil-filled cables. The Brazilian Traction group in 1949 installed in Sao Paulo a circuit of high pressure, oil-pipe type rated at 120 kv but operating at 88 kv, and in Rio in 1950 a low-pressure, oil-filled cable rated at 180 kv but operating

TABLE I—Sao Paulo Generating Facilities

Cubatao above-ground plant	474,004 kw
Itupararanga Plant	56,124 kw
Piratininga Plant (maximum)	200,000 kw
Small Plants	40,160 kw
	770,288 kw

TABLE II—Statistics of 230-Kv Cable

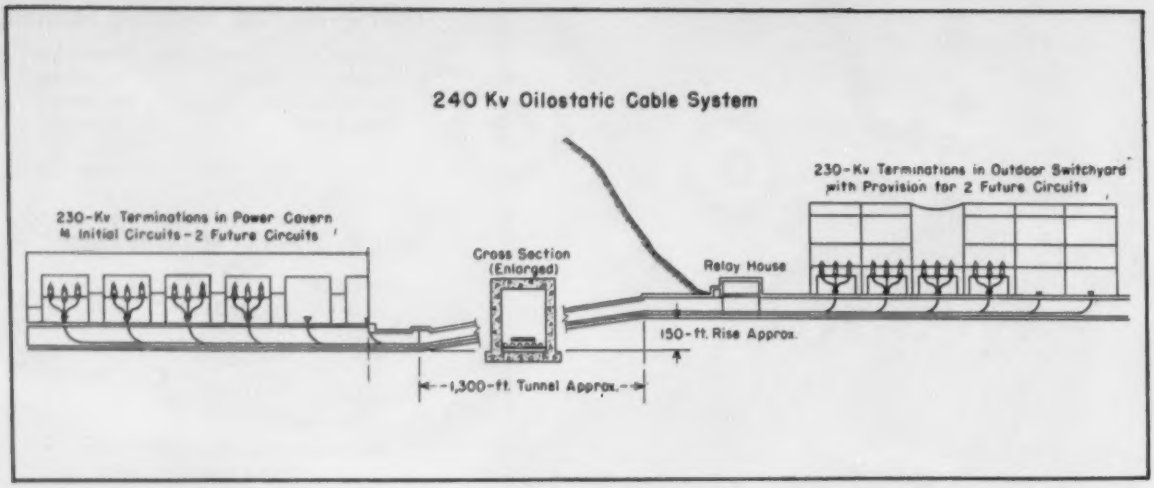
Conductor		
	Size	500 MCM
	Material	61 x 0.0905 in.
	Temper	Hard drawn
Insulation		
	thickness	0.835 in.
	Including	3 metallized paper tapes
		36 x 3 mil paper tapes
		63 x 5.5 mil paper tapes
		60 x 6.5 mil paper tapes
Shield		2 perforated metallized paper
Skid wire		No. 1
		Dimensions 0.102 x 0.204 in.
		Lay—1½ in. approximately
Sheath		Thickness—0.078 in.
		Material—plain lead
Pipe	Overall diameter	8⅝ in.
	Wall	0.25 in.
	Type	Electric Weld
	Specification	API 5L Grade A
Finish	Inside	Shot blasted and a coat of rust-resistant paint
	Outside	Shot blasted and a coat of coal tar enamel

TABLE III—High-Voltage Time Test

Test Potential-Kv	V Per Mil	Duration-Hr
284	340	6
359	430	3
433	520	3
550	660	3
660	790	3, or until failure

TABLE IV—Impulse Tests on Prototype Cable

	Specified	Obtained
Wet withstand—60 cps	385 kv	464 kv
Dry withstand—60 cps	465 kv	550 kv
Impulse crest	900 kv	
Wet—Positive		>1,000 kv
Negative		<1,050 kv
Dry—Positive		>1,160 kv
Negative		<1,100 kv

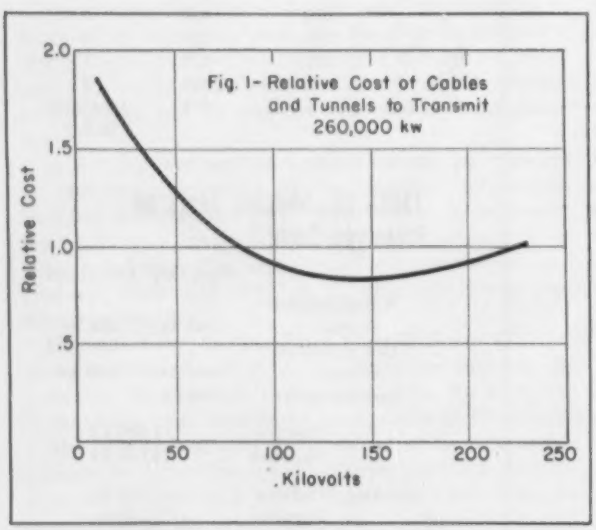


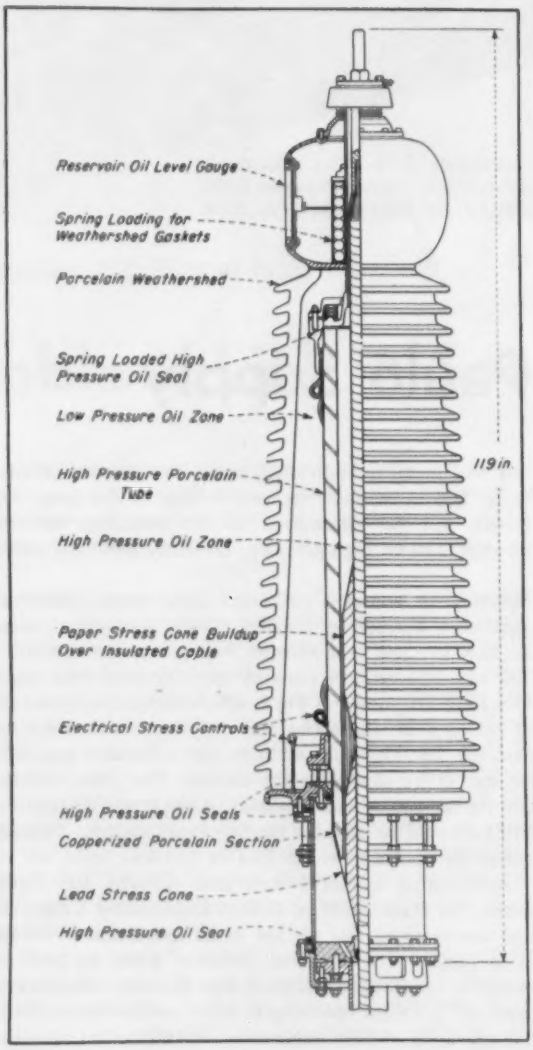
CROSS-SECTION (above) shows 230-kv cable with 500-MCM copper conductor and insulation, D-shaped copper armor, and other steel pipe. Pothead (right) is of the dual porcelain tube type, the inner tube confining oil and outer being corrugated to act as a weather shed

sure, oil-filled cable rated at 180 kv but operating at 138 kv. The extensive acceptance tests on these cables showed clearly that the American manufacturers could go to higher voltage ratings and that 230 kv was well within the possible range. The 230-kv cables were selected for these reasons combined with the relative costs.

An order was placed in March 1951 for the 230-kv cables and accessories for the underground power plant. In 1951, AEIC issued its Specifications for Impregnated Paper-Insulated Cable, High Pressure, Pipe Type, which includes provisions for cables up to 230 kv between phases.

Cable Description . . . Practically all high-voltage cables in Europe are of the medium oil pressure, self-contained type, and in most of these cables joints were installed. The experience of Brazilian Traction and others indicated, however, that great lengths of high-pressure, pipe-





type cable could be pulled, even where bends were included, thus minimizing the number of joints. At Cubatao, the distance between the transformers and the switchyard is approximately 1,500 ft. The use of pipe-type cable obviates the need for joints which would be required on a low- or medium-pressure, oil-filled, self-contained cable.

Satisfactory joints have been made in 230-kv cable, but in the field they are made under less favorable conditions than in the factory. Joints cost money and take time to install. For the pipe-type cable the cost of material for a joint alone is equivalent to that of 50 ft of cable circuit. Brazilian Traction decided that high-pressure, oil-filled, pipe-type cables would be more economical.

To keep maximum electrical stress at the conductor's surface within the allowable 300-v-per-mil limit, a conductor of at least 500 MCM cross-section was needed. A 750 MCM aluminum conductor, having a lower unit stress and approximately the same current-carrying capacity, was considered and rejected. Its decreased maximum stress on the dielectric would not offset its increased size.

The current carrying capacity of the 500 MCM copper-conductor cable is greater than the 200 amp required, and studies were made with the view to reducing the excess. A hollow-cored conductor allows the impregnation of a heavy wall of insulation from both outside and inside. Experiments showed, however, that insulation can be impregnated thoroughly from the outside alone. It was decided to take advantage of the lower losses of concentric stranded conductor which costs about the same as a conductor with hollow core of the same diameter.

Potheads and Bushings . . . Potheads, transformer bushings, and circuit breaker bushings are designed for a BIL impulse strength of 900 kv on 1½ x 40-microsec wave. Impulse tests on the cable had previously determined the expected average impulse strength. Accordingly, a cable could have an expected impulse strength greater than that of its associated bushings, even when insulation thickness was reduced below the normal specification. But calculations showed that the reduction in cable diameter was not enough to permit using smaller-diameter pipe, and Brazilian Traction felt greater safety justified conventional insulation thickness.

While it was theoretically possible to reduce both the conductor area and insulation thickness, such reductions entailed no economic advantage. Thus final design of the cable was strictly in accordance with the AEIC specifications. The access tunnel, through which cooling air will be drawn, is at the foot of the hill close to sea level and approximately on the Tropic of Capricorn. In this region the air may reach a temperature of 90 F for days on end. Consequently, the low temperature rise of the cables due to the large conductor size will help reduce the amount of external cooling required. Nevertheless, it is specified that the cable should be capable of operating at a continuous ambient temperature of 120 F.

Proof Test Procedure . . . The Edison specifications include adequate test procedures for acceptance of 230-kv cables. Because manufacturers were entering unfamiliar territory, however, Brazilian Traction considered it expedient to require additional tests to prove the satisfactory design and construction of the cables. Prototype cables, similar to those eventually ordered except that they had a 750-MCM aluminum conductor, were assembled with commercial potheads. Impulses were applied from 650 to 1,110 kv at various oil pressures. When insulation showed no apparent damage, Brazilian Traction considered it unnecessary to repeat the impulse tests on the cable of final design.

The dielectric loss and power factor tests were made in accordance with section 12.4 of the AEIC specifications, with the exception that the power factor was measured at each temperature at voltages of 60, 83.5, 133, and 167 kv. Such measurements permitted calculation of the power factor at rated voltage and determination of the ionization factor at each temperature.

A high-voltage time test similar to that covered by section 12.6 of the AEIC specifications was made. But instead of limiting the potentials to three steps, the cables were tested at 284, 359, 433, 550, and 660 kv.

Cyclic Loading Test . . . A cyclic loading test was made on a sample of the cable and two commercial potheads. These were assembled with a pipe and filled with oil at 150-psi pressure. Current was passed through the conductor to heat the cable. The dielectric loss and power factor over a temperature range were measured at the beginning, and the power factor at various voltage stresses was measured to enable calculation of ionization. These voltage stresses were 50, 100, 200, 240, and 300 v per mil.

A cyclic loading test followed in which the full load current of 500 amp was passed through the conductor for 8 hr. A potential of 200 kv was then applied for approximately 16 hr. At each transition between high current and high voltage, the power factor was measured at 240 v per mil, or 200 kv. The radial power factor was measured on representative samples of cable removed before and after the cyclic loading test.

Potheads . . . In European practice potheads and transformer terminals are installed together in an oil-filled housing. This construction reduces the size of the bushings because of the increased flashover strength under oil and avoidance of exposed connections at high voltage.

Brazilian Traction, however, selected conventional cable and transformer terminals because saving space was unimportant and because American manufacturers are unfamiliar with the combined oil-filled housing for such a high voltage. Open construction also facilitates replacement of transformers and cables.

The potheads selected are the dual porcelain tube type, the smooth inner tube confining the oil at high pressure and the corrugated outer tube acting as a weather shed and containing oil at atmospheric pressure. These potheads are used also in the power cavern and at the switching structure. The impulse tests on the prototype cable with two commercial potheads installed proved the pothead design from a potential standpoint, and the results obtained are shown in Table IV. These figures have been corrected to standard conditions.

Each pothead was also tested at 150F with oil at 500 psi in the pressure tube for 8 hr, and a check was made on the gaskets of the weather shed at a pressure of 10 psi for 15 min.

Oil Pressure System . . . Because of the distance from the insulating oil supply, operating and maintenance re-

(*Continued on page* 166)

Improved techniques including incremental transmission and fuel costs yield large savings when . . .

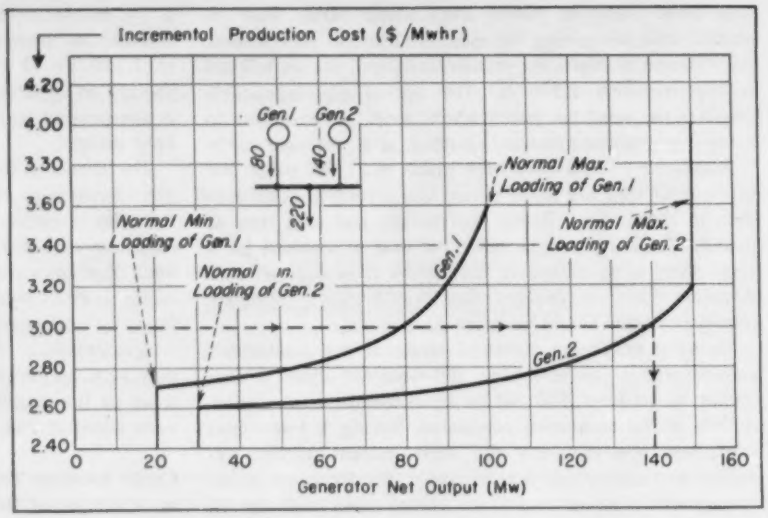


FIG 1—SIMPLEST EXAMPLE of ECONOMIC DISPATCHING is two generating units in the same power plant. Economic loading is based on their incremental production costs

Modern Power Dispatch Evaluates

D. C. HARKER and M. C. WESTRATE, System Planning Section, Commonwealth Associates Inc, Jackson, Mich.

Supplying system loads at minimum cost consistent with good service is one of the major aims of power dispatching. The art has become more exact and more exacting in recent years. More accurate determination of economic dispatch curves for multi-station systems is now possible by improved techniques in calculations and new developments in automatic computers. With the growth of power systems, and more interconnections between them, it is expected that the use of economic dispatch curves determined from loss formulas will increase rapidly.

An overall picture of station loadings for maximum efficiency and minimum production cost is then possible for the system operator. Principal uses of the dispatch curves are to:

1. Indicate load to be carried by plants of various efficiencies, fuel costs, and distances to system load center.
2. Indicate efficient scheduling with a generator off.
3. Indicate changes in scheduling when a new unit or a new transmission line is placed in service.
4. Revise schedules when fuel costs change.
5. Assist in studies to determine size, location, and type of additional generation facilities.

On interconnected systems loss studies will tell:

1. The cost of delivered power at interchange points.
2. The scheduling of purchased or sale power for maximum economy.
3. The correct charge for transfer through the system.

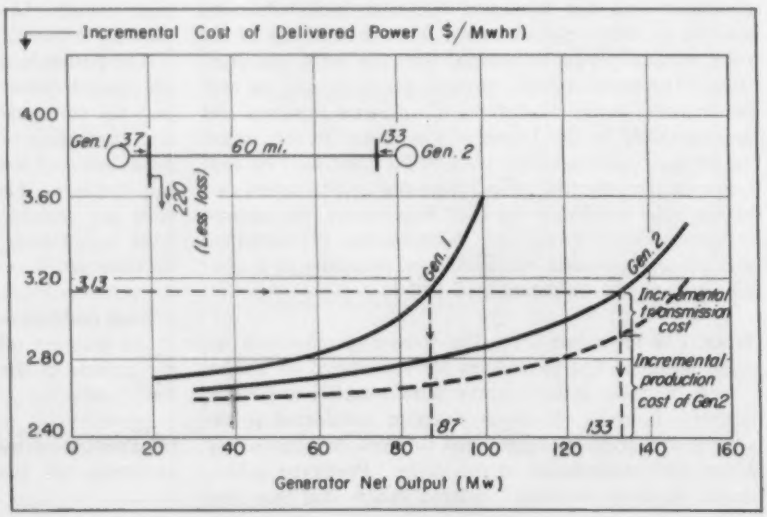


FIG 4—LOAD CENTER POWER COST is determined by adding incremental transmission cost to incremental production. Adjacent figure illustrates derivation for Gen. 2

FIG 5—ECONOMIC DISPATCH for these generators with transmission loss added for Gen. 2 is shown on the opposite page. Comparison with Fig 2 shows effect of losses

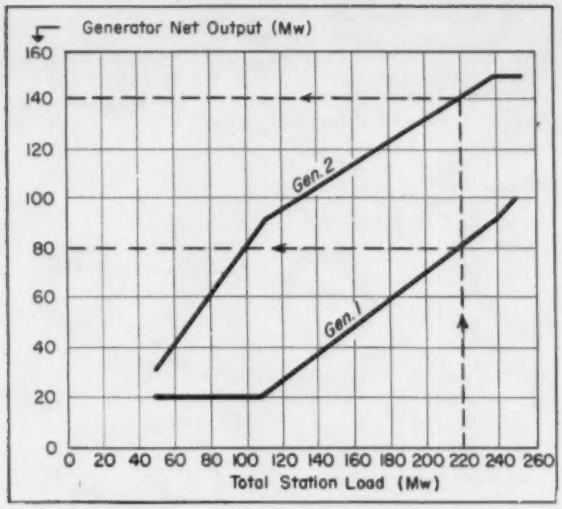


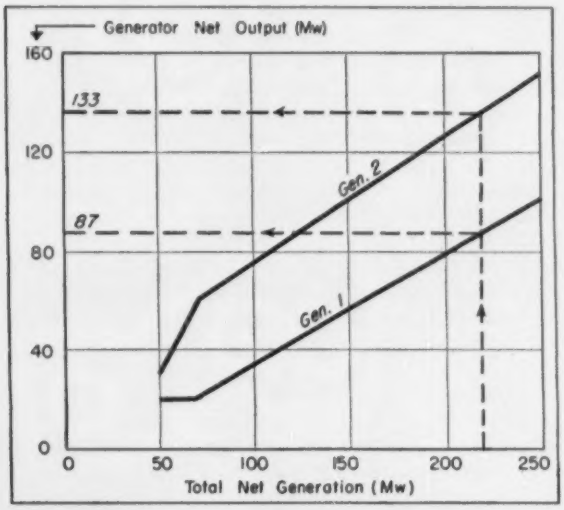
FIG 2—ECONOMIC DISPATCH for the simple example, Fig 1, gives generator loading curves based on incremental power production

Line Losses

4. Scheduling of total systems to achieve maximum economy for overall operation in a power pool.

Economic dispatching can save many thousands of dollars each year by coordinating incremental fuel costs and transmission line losses. A relatively simple problem with one or two generating plants becomes rapidly more complex with the addition of plants, transmission lines, and interconnections. An elementary example will be used to illustrate the basic problem. The dispatches of two rather complicated systems are shown but with mathematics and other details omitted so as to bring out results studies rather than computational procedure.

Example of Two Plants . . . Incremental production cost curves for two generators in the same plant are shown in Fig. 1. These generators are most economically loaded when their incremental production costs are the same, that is when each increase in load is picked up by the unit that can supply the increase at the lowest cost.



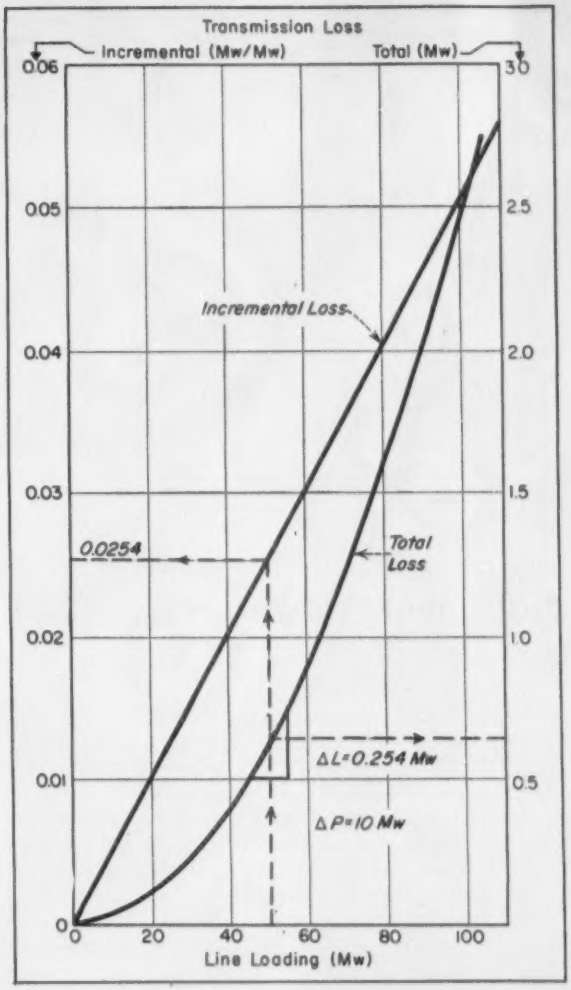
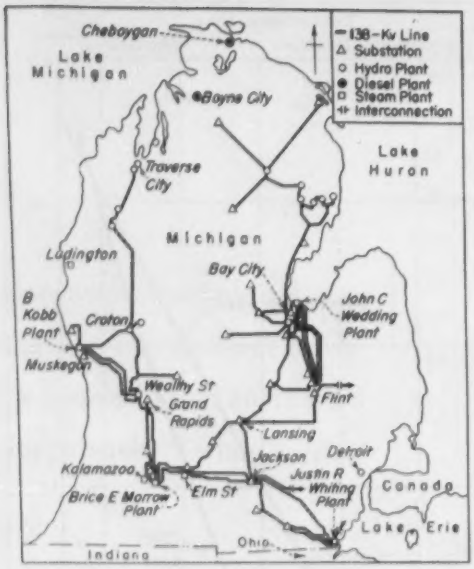


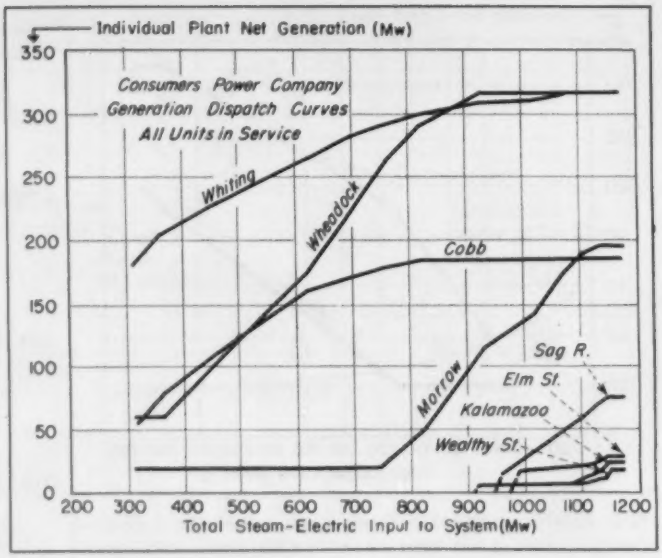
FIG 3—INCREMENTAL TRANSMISSION LOSS counts when there are several points of supply. It must be determined for each line load

With Generator 1 supplying 20 Mw and Generator 2 supplying 30 Mw, suppose that the total load increases from 50 Mw to 60 Mw. The 10-Mw increase should be picked up by Generator 2 because it can do so at a cost of $2.60 per Mwhr; whereas, if Generator 1 picks up the increase the cost would be $2.71 per Mwhr.

Applying the principle of incremental loading to the generator curves results in Generator 2 taking successive load increases until its net output is 90 Mw and the total load is 110 Mw. Further increases in total load should then be shared until Generator 2 reached its normal maximum loading of 150 Mw. Beyond that the increases would be taken by Generator 1. The resulting economic dispatch or generator loading curves based on equal incremental production costs is shown in Fig. 2.

Transmission Penalty Factor . . . Now suppose that Generator 2 is 60 miles from the load center. To its incremental production cost at each value of load carried must be





Consumers Power System constants were determined with network calculator and digital computer. Economic dispatch sets station loadings for various system outputs as plotted above

added the incremental cost of transmission loss involved in delivering any additional output of Generator 2 to the load. The total and incremental losses for the transmission line for various values of line loading are shown in Fig. 3.

The incremental transmission loss at 50 Mw, for example, is 0.0254 Mw per Mw. That is, the loss increases 0.0254 Mw for each megawatt of increased load when the line is initially carrying 50 Mw.

Another way of stating this is that for each additional megawatt delivered about 1.0254 Mw must be generated. Then for further accuracy, the losses caused by the losses themselves should be included, thus requiring that 1.0261 Mw be generated for each additional megawatt delivered. This is the penalty factor for Generator 2 at 50 Mw by which its incremental production cost must be multiplied to determine the incremental cost of delivering a small increase in power to the load over an initial 50 Mw.

Transmission Cost Added . . . Incremental transmission cost is added to incremental production cost of Generator 2, as shown in Fig 4, to obtain the incremental cost of power delivered at the load center. Then when Generator 2 is carrying 133 Mw, Generator 1 should carry 87 Mw so that the incremental cost of delivered power for each unit is equal, at the value of $3.13 per Mwhr. The generators are then loaded so that the total load of 220 Mw will be carried at minimum cost.

These generator loadings may be compared with those of Fig 1 which indicate that without transmission loss included Generator 2 should carry 140 Mw while Generator 1 should carry 80 Mw. At these values, Fig 4 shows that with transmission loss included the incremental cost of delivered power from Generator 2 would be $3.23 and from Generator 1 it would be $3.00. This condition does not satisfy the principle of equal incremental delivered cost for the generating units, and hence minimum production cost would not be obtained.

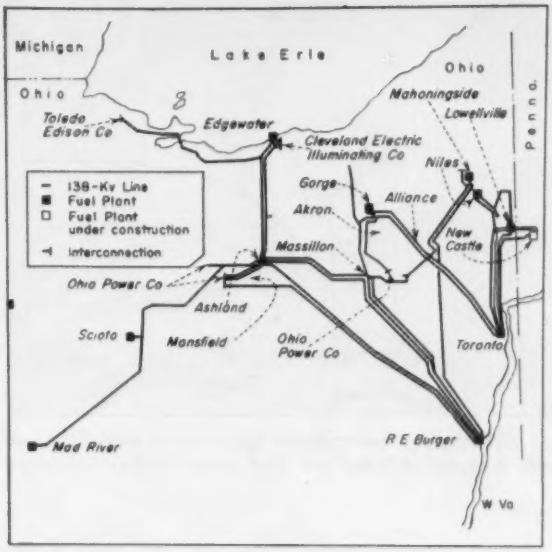
The generator loadings given by the incremental cost curves of Fig 4 are transferred to the economic dispatch curves with transmission loss included in Fig 5. By direct reading then the values of 87 Mw for Generator 1 and 133 Mw for Generator 2 are determined for the total generation requirement of 220 Mw.

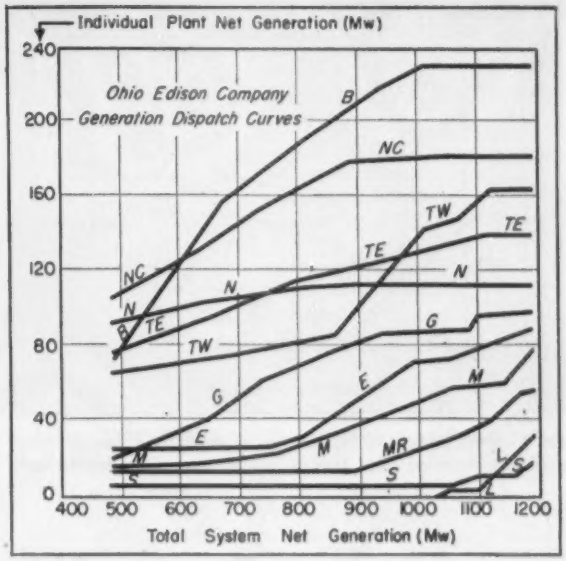
System Loss Formula . . . This simple process of determining system dispatch graphically might be continued indefinitely as long as additional generating units are connected radially to the load center. But the problem becomes considerably more complicated when transmission loops are involved and loads supplied from several substation buses. Then the mutual influence of the output of one generator upon another because of simultaneous loading of sections of the transmission system requires a transmission loss formula to account properly for the effects.

Derivation of a system loss formula may be by any one of at least three methods. Commonwealth engineers, in conjunction with Westinghouse engineers, developed and verified a loss formula applicable to the Consumers Power Co system. The complete mathematical basis was presented at the AIEE Winter General Meeting, Jan. 1954.

For a small system basic ac calculating board studies and a desk caculator may be sufficient to develop economic dispatch curves. The number of terms included in a loss formula increases rapidly, however, with the number of generating sources and tie points. There are 136 terms in a loss formula for a system with 16 power sources. In this case, one of the newly developed computers is essential. Further development and application of special dispatch computers is desirable for multi-station systems where fuel costs and other conditions are frequently changing.

Application of Formula . . . A simplified diagram of Consumers Power's 138-kv system is shown above. Constants of the transmission loss formula were determined by using a network calculator for basic load flow studies and a digital computer (CPC) for carrying out the computational





Ohio Edison

Interconnections complicate 138-kv loss formula. But economic dispatch is simple because tie points are near load center. Curves above show generating schedules for various system outputs

work. The formula was then verified for the range of conditions considered likely.

Next step in any dispatch or loss evaluation study is coordination of incremental loss equations derived from the loss formula with incremental station production costs. The final step is solution of the coordinated equations to give the economic dispatch of generation over the normal range of system loads.

An example of the Consumers Power dispatch of steam-electric generation is also shown. Hydro-electric generation, although influencing the dispatch of steam generation and taken into account, is not shown because hydro dispatch is based on other considerations.

Daily application of these curves is indicated in the dispatch for the new high efficiency, low fuel cost Justin R. Whiting Plant on Lake Erie. This plant should carry considerable generation even at lighter system loads, and at 70% system load it should operate at 95% of its normal maximum output, even though most of its output must be transmitted about 65 miles before reaching the main part of the system.

These curves also show that Bryce E. Morrow Plant, even though favorably located with respect to major load centers in the southern part of the system, should be operated at minimum generation up to about two-thirds system load because of its relatively higher fuel cost. The dispatch clearly separates newer, more efficient plants like Whiting, Cobb, and Weadock from those of an earlier period such as Saginaw River and Elm Street. Although these latter plants are located close to sizeable local area loads, they should not be put on the line until after the system load reaches 85%.

A More Complicated Application . . . Characteristics of Ohio Edison Co's 138-kv transmission network offer a considerably different type of loss formula problem. This system is an interconnected network with supply sources at numerous points and with large generating plants delivering power at several points on the network. For such a system there is no simple method of determining the dispatch and without a loss formula it would be almost hopeless to determine the economic loadings of the various stations with any degree of reasonable accuracy.

It was found that on this system, although power flow over interconnections with neighboring companies changes the losses, there is little effect on the economic dispatch because the interconnecting points are relatively near the system equivalent load center. This differs from the Consumers Power system which has one interconnection directly off the major power station bus and another at a major load.

Some very helpful simplifications can be made where power flow over interconnecting ties does not significantly influence the dispatch of generation. For example, if tie line flow does not appreciably affect system dispatch, it immediately follows that sale power may be dispatched the same as system load. This not only greatly simplifies the dispatcher's daily problems but also enables the cost of sale power to be determined accurately and with much greater facility.

Economic Dispatch for Periods of Generator Outage . . . For some systems a different set of dispatch curves may be needed when units are out of service to indicate the economical loading for the remaining units. On the Ohio Edison system it was found that a very close approximation to the correct dispatch could be obtained from the dispatch curves for all units in service.

If a unit is out of service, the economic dispatch for other units can be determined by adding the load it should be carrying to the actual sytem load and reading the dispatch curves for the adjusted valve. Loading of the station with the unit out of service is reduced by the load this unit would be carrying.

Economic dispatch, made necessary by the growth of power systems, is contributing to their economy.

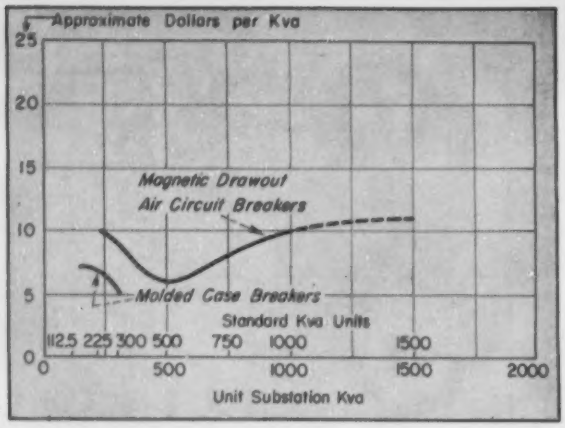


FIG 1—UNIT SUBSTATIONS cost less at 480Y/277 v. Savings shown exclude installation cost. Molded-case breakers serve smaller units

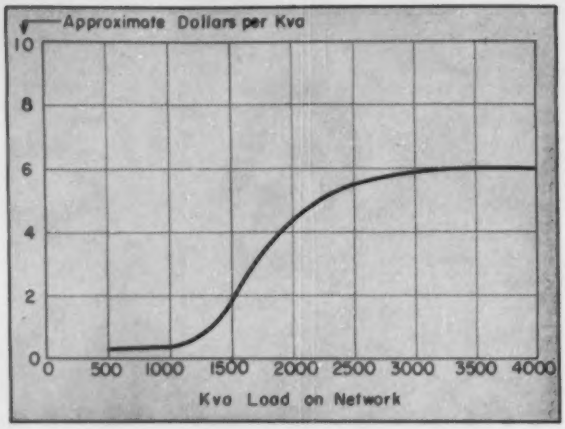


FIG 2—ENTRANCE SWITCHGEAR costs less at 480Y/277 v for loads in excess of 1,000 kva. Cost savings exclude installation

Parameters Indicate Where

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General Electric Co, Schenectady, N. Y.

Electrical system design for an office building today requires an early decision between 120/208Y and 480Y/277 for its supply voltage. Parameters favoring the higher voltage are these:

1. Motors and fluorescent lighting suitable for 480Y/-227-v supply in excess of 33 to 50% of total load.

2. Building feeder length averaging 200 ft or more.

Building location is important if it influences the types of service available. Primary power gives the owner free choice of wiring voltage. But where secondary network service is provided, an additional parameter is a total demand of 1,000 kva or more. Stepping up to 480Y/277 from 120/208Y-v service is feasible only where demands are very large and preponderately from 440-v motors or lighting which can operate at 277 v.

These parameters help architects and engineers determine where 480Y/277 v should be considered in their building plan. Use of this voltage is permitted with but minor restrictions by the 1953 National Electrical Code, and no problems should arise where local codes are in agreement with it.

Savings in a higher-voltage system reflect its ability to utilize electrical distribution equipment more efficiently, the equipment used being basically of the 600-v class. At 480Y/277 v, such equipment can carry more than twice the power possible at 120/208Y v. Every building, however, contains portable equipment and incandescent lamps which, in compliance with code and safety restrictions and because of their availability, require a 120-v supply. Cost of small 480-120-v, dry-type transformer capacity for serving this load must be included in determining overall savings.

Analysis shows how distribution system components contribute to overall savings at 480Y/277 v. The components analyzed are main unit substations for primary service, entrance switchgear for secondaries, cable or bus feeders, risers, panelboards, and branch circuit wiring.

Primary Service Transformers and Switchgear . . . When primary power supplies a building, the main unit substations are the equipment where the first savings can be realized. Primary switchgear and transformers are practically the same for either voltage. But the interrupting duty of 480Y/277-v secondary breakers for the same size transformers is lower and the current-carrying ratings less than half those required at 120/208Y v. Approximate dollars-per-kva savings at the higher voltage for various standard substations are given in Fig 1, in which each substation is assumed to have six feeders and the 480Y/-277-v breakers half the current-carrying capacity of 120/208Y-v breakers. Accordingly, substation savings per kva vary from about $6 to $10 where magnetic-drawout air circuit breakers are used and $5 to $7 where breakers are of molded-case type. Savings also vary directly with the number of feeders.

Secondary Service Switchgear . . . Network rather than building requirements establish switchgear interrupting ratings when the building is in an area supplied by the utility from a secondary network. Even though each transformer requires a lower-interrupting-capacity breaker at 480Y/277 v than at 120/208Y v, utilities sometimes use larger concentrations of transformers in each vault at 480 v. Interrupting duty at the building entrance then might be equal to or greater than for the 120/208Y-v system. Approximate dollar-per-kva savings on the network are given in Fig 2. These are minor until demand grows enough to require several entrances at the lower voltage when savings in entrance switchgear can range up to approximately $6 per kva.

Feeders and Risers . . . At higher voltage savings may be realized in feeders and risers because cable or busway size is fixed by current-carrying ability and voltage drop. A 480-v conductor can carry twice the load of a 208-v conductor at half the percentage voltage drop. Approximate savings in dollars-per-kva of building demand are

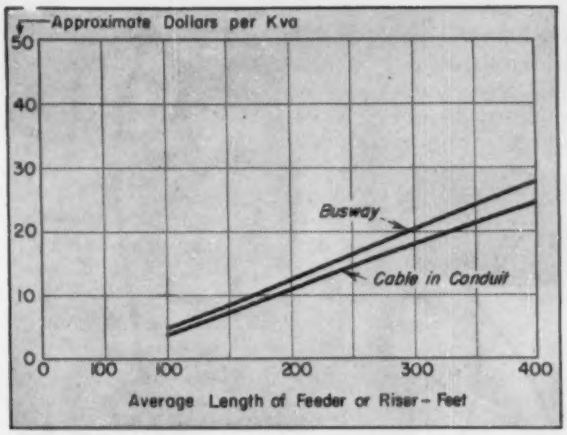


FIG 3—BUILDING FEEDERS AND RISERS cost less at 480Y/277 v. Savings include installation and are almost proportional to length

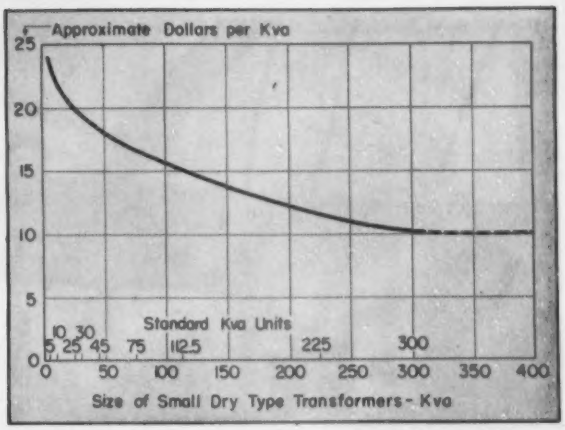


FIG 4—DRY TYPE TRANSFORMERS required for 120-v devices boost cost of 480Y/277-v. 25% of transformer cost is for installation

480Y/277 V Saves Wiring Dollars

given in Fig 3 for different average feeder lengths. These curves are based on averages for the various sizes of cable and busway commonly used in commercial buildings. As average feeder length approaches 400 ft, savings rise to approximately $28 per kva.

Small dry-type transformers are an additional cost of the higher-voltage system. Fig 4 gives the approximate installed cost in dollars per kva of 120/208Y-v load for various sizes of transformers. Ratings from 5 to 25 kva are single-phase, and larger ratings are for 3-phase units. While larger transformers cost less per kva, low voltage distribution over longer distances costs more.

Lighting panelboards cost more per 277-v circuit than per 120-v circuit, but half the number of 277-v circuits can serve the same load. Building layout determines whether the total cost of 277-v lighting panelboards is more expensive than their 120-v counterparts. At the higher voltage savings can be realized in lighting panelboards and branch circuit wiring although the slightly more expensive fluorescent fixtures may cancel the savings. Motors and associated controls cost slightly less at 480 v; and although such savings are not considered here, they may be weighted in making a choice between higher and lower voltage supply.

Small Building Planning . . . The higher voltage is more economical for a small building so situated that primary service is available and its use is warranted by electrical load. When less than a third of the load can be supplied at 480Y/277 v, the length of secondary feeders should be considered. Where these average at least 200 ft, the higher voltage is economical regardless of the portion of the load that can be served at 480 v.

Consider a two-story office building with a 200-kva demand and primary power available. Assume that feeder lengths average 100 ft and the load to be supplied at 120 v is 100 kva, or half the total. Where such a building is supplied by a 225-kva substation with molded-case breakers, substation cost savings at the higher voltage, according to Fig 1, are approximately $7 per kva. A saving of approximately $4 per kva can be realized in the secondary feeder, according to Fig. 3. Total potential savings are $11 per kva.

At 120 v, a 100-kva load must be supplied by small dry-type transformers. Assuming 10 kva the average size, these transformers, according to Fig 4, represent an additional cost of $22 per kva. As this cost is applicable to half the total load, it adds $11 per kva to the cost of serving the building, thus offsetting substation and feeder

(*Continued on page* 168)

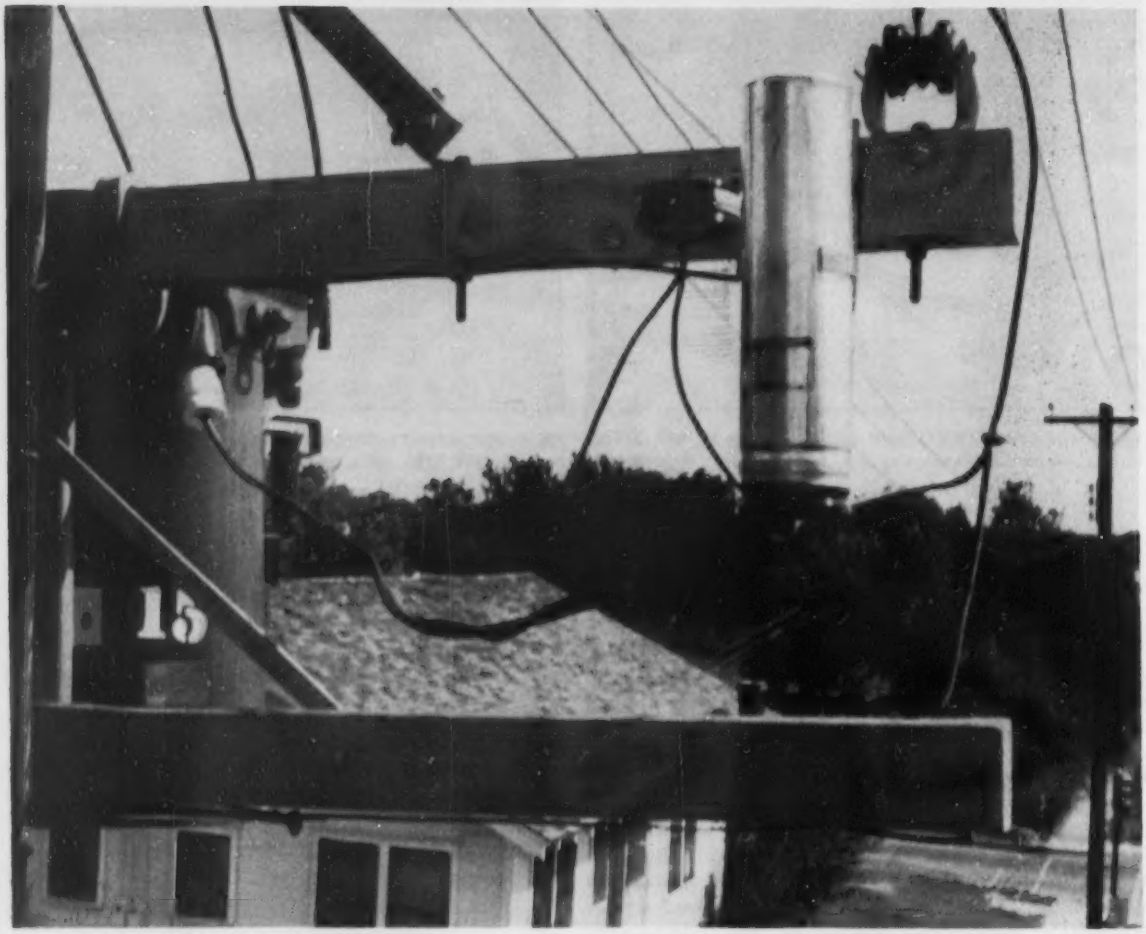
480Y/277 or 277/480Y—Which?

Throughout this article the author has followed industrial practice in referring to the higher voltage as 480Y/277. In industrial plants, the principle use for power is at line-to-line voltage either polyphase or single phase. Hence the line-to-line voltage is considered the most essential and is used as the voltage designated. In the EEI, NEMA standards the only polyphase voltages above 208 v are rated as line-to-line, ie., 240, 480, 600.

When the 120/208Y system was originally adopted, and this is probably still true today, the most significant use of power was at line-to-neutral voltage. As the line-to-neutral voltage was the most significant, it was naturally placed first in the EEI, NEMA, and ASA standards.

Some utilities have continued this practice in placing the line-to-neutral voltage first when they adopted the higher voltage system. Thus today we find the designations 277/480Y or 265/460 v used in referring to the same voltage system as is designated 480Y/277 v by the author in this article.

Electrical World editors invite readers to express their preference. Readers Forum is available to present their views.



CAPACITOR is shown connected in transformer primary leads, an effective combination employed by Oklahoma utility in clearing localized transformer hot spots. Size of 240-v capacitor is determined by the size of distribution transformer with which it has been paired

240-V Capacitors Meet Demand

Installed in primary leads of 2,400-v transformers, units boost service voltage depressed by cooling

A. R. MILLIKEN, Distribution Engineer, Public Service Co of Oklahoma, Tulsa, Okla

With the approach of the summer of 1954 the Public Service Co of Oklahoma was somewhat concerned about the rapid increase in load resulting from window-type air conditioners. The problem with this load is accentuated by the fact that there is no way of telling when or where the load is being added until the hot weather comes.

It came to the system this year with a bang. During July, Tulsa experienced 17 consecutive days in which the temperature went over 100F. This represented the most protracted period of extremely high temperatures in 18 years.

System demand soared on each successive day and reached a high just short of the estimated peak for 1955.

Except for isolated hot spots on the distribution system,

involving overloaded transformers principally, the system met the demand satisfactorily. For the purpose of promptly clearing up hot spots involving overloaded transformers the use of the 240-v capacitor in series with the 2,400-v distribution transformer was found to be of inestimable value, Fig 1.

The Tulsa area engineering department had been experimenting for about a year with this development with a view to eliminating the drop through a 2,400-v transformer and substituting a rise instead. It was hoped that the practice would prove effective as a general method of improving transformer regulation.

This combination would eliminate the necessity for a detailed engineering study which had always preceded a series capacitor installation.

Trial Installations . . . Several trial installations were made. The first was of one 3-kva, 240-v secondary capacitor in series with a 15-kva, 2,400-v distribution transformer, Fig 2. Provision was made for metering the primary and secondary voltage, Figs 3 and 4, as well as the transformer load and power factor. Later a 25-kva, 2,400-v transformer with one 3-kva, 240-v capacitor included in the high side circuit was placed under observation with the same metering arrangement. Still later, observations were made on a 37½-kva transformer which had a 5-kva, 240-v capacitor in series.

Results obtained from these three test locations were so promising that a total of 50 installations was planned to provide a more thorough field test. These 50 installations were about completed last summer when the heat wave struck.

Work Accelerated . . . Voltage complaints poured in, and the load checking of transformers was accelerated. At the same time there was an unprecedented number of new air conditioning installations. Even by using available contract labor, the transformer changeouts could not keep pace with complaints.

Faced with this situation the number of series installations was increased from 50 to 100, from 100 to 150, and then to 175.

More installations are planned.

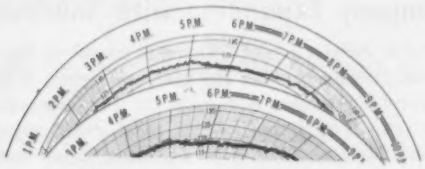
It is estimated that one lineman working with a driver-groundman has corrected as many cases of low voltage, using capacitor in series, as six to eight line crews could have done employing other methods.

The average labor per installation has been less than one hour.

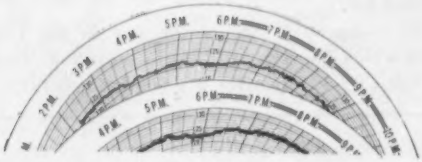
Operating Results . . . While these installations have been made within a comparatively short time, taken together, they represent more than 8,000 operating days. Considering that they were made at random, they represent a good cross-section of residential transformers. Installations at present include 10, 15, 25, 37½ and 50-kva, 2,400-v transformers, and the results have been uniformly gratifying. The voltage benefit gained varies with the combination used, as well as the load and power factor, but has averaged 5% for all installations taken together.

Difficulties generally associated with series capacitors have failed to materialize. Two anticipated problems are limiting of thermal overload to a safe value and protection of the capacitor dielectric in the event of short circuit.

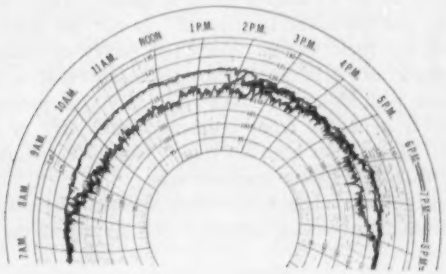
Some installations use a fused transfer switch which by-



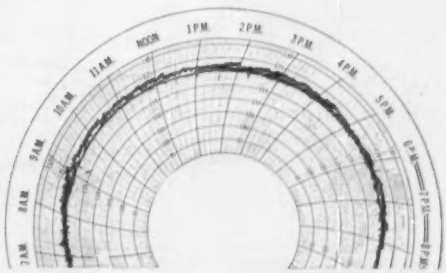
NO CAPACITOR: Top chart shows primary volts on 15-kva, 2,400 120-240-v transformer (20/1 PT); bottom shows secondary volts



WITH 3-KVA, 240-V CAPACITOR: Top chart shows primary, bottom secondary volts. All readings at transformer terminals



AT CUSTOMER'S METER, no capacitor, voltage dropped to 110-111 for several hours. Friday PM-Monday AM period charted



AT CUSTOMER'S METER, after capacitor was installed, voltage showed marked improvement as compared with chart shown above

Company Expanding with Southwest

Public Service Co of Oklahoma is one of the fast growing companies in a fast growing region. It owns the local distribution systems in the 241 communities now served by it and in the rural areas adjacent thereto. It also owns over 240 distribution substations having a rated capacity of over 500,000 kva.

Power generated has practically doubled since 1949. In that year net generation was 955,609,000 kwhr. In 1953 the total was 1,582,549,000. It is expected that this year the total will be close to 1.8 billion. The company has seven major generating stations and ten minor ones with a capability of over 425,000 kw.

The company is one of the few in the United States which has a gas turbine in operation. One at the Elk City Plant drives a 6,000-kw generator.

passes the capacitor in the event of overload, but the result of field applications tends to indicate that the low-voltage capacitor has more thermal capacity than is generally realized.

Capacitors with a rating of 12.5 amp at 240-v have repeatedly been cut in on installations where the load was running 17 to 18 amp without a failure. How the total life of the capacitor is affected has not yet been determined, but these values represented heavy overloads.

Results of field applications indicate that a thyrite arrestor with 60-cps breakdown of 1,000 v protects the capacitor dielectric from accidental secondary or service short. There have been only four capacitor failures, and those that failed were unprotected.

None of the capacitors which shorted out caused an interruption in service although one stayed in the transformer circuit in the short-circuited condition for several months.

So far, the only objection against the general application of secondary capacitors in series with transformers is the lack of capacitor sizes which coordinate to best advantage with all commonly used sizes of distribution transformers. A 4-kva, 240-v capacitor is particularly needed for coordination with the 25-kva, 2,400-v transformer. It is expected that such sizes will be available in the near future.

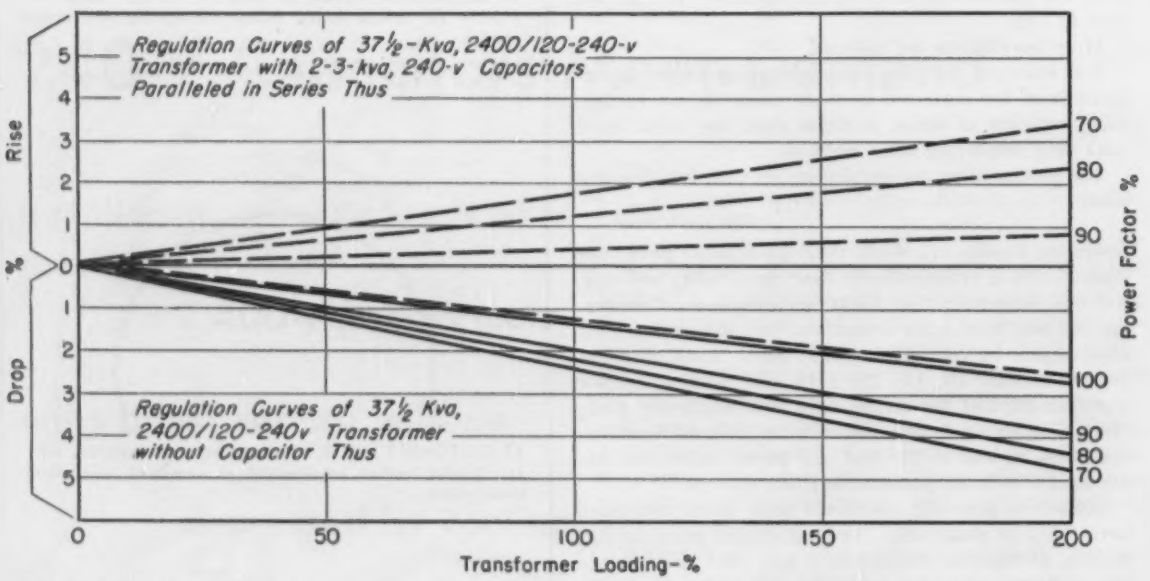
Transformer Becomes Regulator . . . By installing a capacitor in series with the transformer, the transformer in effect becomes a voltage regulator. As maximum load and poor power factor, which normally produce the greatest voltage drop, the combination gives the greatest voltage improvement. At light load or good power factor, normally resulting in good voltage, the combination contributes nothing.

In addition to the voltage regulating effect the series capacitor supplies leading vars to the system. The vars supplied are in proportion to the current flowing through the capacitor which favors loading the capacitor to the limit of its thermal capacity.

Where desirable, a capacitor may be used in series with the transformer while other capacitors are installed in shunt on the secondary served by the transformer. With this arrangement the more capacitors applied in shunt, the less voltage rise is gained from the series capacitor. This makes it appear that the two applications are in conflict.

But the second capacitor applied in shunt will also produce less results than the first, the benefit being decremental. The results are obtained when capacitors in shunt are added to capacitors in series. The results are not in conflict, but decremental.

An application guide for series capacitors is being prepared and should be available at an early date.



VOLTAGE REGULATION shows greater improvement as the power factor decreases as a result of a capacitor being connected in series with the distribution transformer. In combination, the transformer in effect becomes a voltage regulator; capacitor supplies leading vars

Industry Winds Up Jubilee; Fan Letters Attest Success

SAN DIEGO G&E: Beauty queen helps display electrical equipment in California Jubilee Celebration

Electric companies the country over are packing away the bunting, fading out the neon signs, and closing their books on the most extensive celebration the industry has ever sponsored.

Light's Diamond Jubilee is rapidly becoming an entry in the memory books, but it will take several books just to tote up the events. Radio and television time devoted to various local and national aspects of the celebration would probably add up to months. Thousands of pages of newspaper space have carried the story. Most major magazines have carried one or more articles on subjects related to the jubilee.

Poems have been published, lighting contests held, beauty contests and civic parades sponsored, electric plants dedicated—nearly every public relations device was brought into play (see pictures).

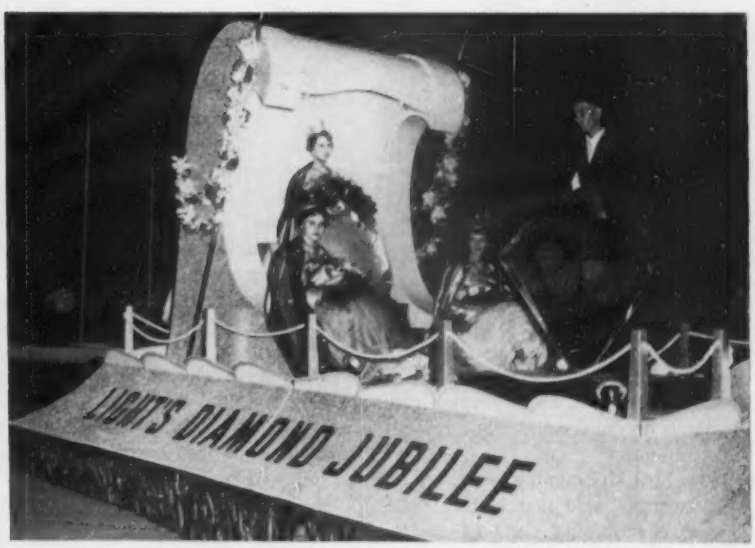
Last week the Light's Diamond Jubilee Committee and N. W. Ayer & Son, Inc, the public relations firm which handled the national aspects, were still trying to put together a picture of the press and other coverage.

Biggest, most expensive single event sponsored was the two-hour, all-network, television show aired Oct. 24 (EW, Oct. 18, p 106). Tabulation of newspaper reviews of this show indicates that of 84 reviews carried in individual papers, 29 were rated highly favorable; 40, favorable; and 15 unfavorable. These reviews appeared in 49 cities in 22 states and the District of Columbia.

More than 300 letters and telegrams have already been received regarding the TV show, and letters were still coming in last week at the rate of eight or ten a day. These were predominately favorable to the show, with less than one in ten expressing objections. One highly prized came from a Marine lieutenant who wrote: "I can only describe my feeling by saying that I believe I am a better American this morning."

The Ayer agency had counted up more than 15,000 newspaper clippings on Jubilee activities, and these are still coming in by the box full. The clipping traffic became so great that the agency discontinued its clipping service request.

NIAGARA-MOHAWK Power Corp: Building lighting display lends color to event



DAYTON P&L: Light's Diamond Jubilee queen rides float displaying huge mirror diamond in Ohio celebration. Many companies sponsored Jubilee floats for local civic parades

W. F. WHITNEY of the Wisconsin PSC, left, new NARUC president, gets a few pointers of the job from the retiring president, C. L. "Roy" Doherty, chairman of the South Dakota PUC

Tax Reduction Favored

NARUC's Pres C. L. Doherty advocates that the regulated industry should have its federal income tax burden lowered

Lower income taxes for the regulated industry was advocated by retiring Pres C. L. Doherty of the National Association of Railroad & Utilities Commissioners before the recent annual convention held in Chicago, Ill.

He thought it desirable for NARUC to consider recommending a "lower federal income tax burden for regulated industry." It is amazing, he continued, "how many well-informed people do not realize . . . we all pay more in income taxes than reflected in our returns. Customers of utilities, when they pay their bills, must make contributions to the customers of the government-aided, tax-free utilities," he declared.

Public service institutions are to be complimented, he added, on handling the large construction expansion program and raising the necessary funds to take care of it while keeping rate demands on the consumer at a reasonable minimum.

The NARUC committee report on "Engineering" said that in the methods of determining costs of classes of utility service a preference was expressed "for use of state-wide or area-wide load curves in making cost allocations in lieu of particular curves for a single company for a specific year. State-wide curves would probably be unsatisfactory when they covered areas where load characteristics differ greatly."

On the question of line extensions, the report stated "It would seem to be a reasonable compromise to accept a little less than the exact cost-of-service from some customers in order to encourage the spread of utility service to more people."

The NARUC committee report on "Valuation" stated "During the past year, a number of commissions and courts have given consideration to the changes which have occurred in price levels. The degree of acceptance and the methods of allowing for the price changes have shown a wide range of variation, and there has been little indication as yet of any consolidated opinion as to the best procedure to be followed."

The committee noted that current thinking on price levels was to the effect that prices would not return to where they were before the war.

With regard to fair value, the report stated "Commissions in at least ten states are currently giving some recognition to fair value; these being, Arizona, Delaware, Illinois, Indiana, Maine, Maryland, Montana, New Mexico, Ohio, and Pennsylvania. In North Carolina in a telephone proceeding, the case was remanded in 1954 to the commission by the Superior Court with instructions to find fair value. On appeal to the State Supreme Court, the value findings of the Superior Court were upheld. Courts in Texas have also allowed recognition of current cost, making a total of twelve states where either courts or commissions have recognized this factor."

In commenting on the rate of return, the report said in part "it has been contended by some witnesses in rate cases that the so-called cost of money has in it all the adjustment necessary to compensate investors for the changing value of the dollar so that it is unnecessary to make any such adjustment to the rate base. Other experts have opposed such a contention, claiming that the cost of capital is nothing more than the earnings necessary to raise one dollar of new capital, both in the current devalued dollars of today. They claim that in order to maintain the real value of the investment, the cost of capital must be applied to a base correctly reflecting the changing value of the dollar."

Price Level Changes

The report continued: "The view is held in some quarters that while an adjustment of some kind is required for price level changes, it need not necessarily be in the rate base. Included among those who hold this view are the proponents of so-called economic depreciation. They claim that when price levels have changed, depreciation accruals based on original cost fail to reflect the true plant costs assignable to each accounting period, and that an allowance in the price-fixing process to correct this deficiency is necessary to prevent the enterprise from suffering adverse effects from price changes," the valuation committee report declared.

"Opponents of economic depreciation allowances in ratemaking point

out that such allowances would not be deductible for income tax purposes so that ratepayers would have to provide about $2 for every $1 of economic depreciation allowed. Others claim that economic depreciation allowances would constitute a contribution of capital on the part of the ratepayers for the benefit of investors."

The NARUC committee report on "Depreciation," in a comprehensive report of some 25 pages of fine print, rejected the whole premise of economic depreciation.

The report mentioned the fact that economic depreciation, based on value or replacement cost, received adverse rulings both by the Interstate Commerce Commission in 1931 and by the Supreme Court of the United States in the case of the Hope Natural Gas Company in 1944.

Replacement Plant Costs

The report noted that "the main argument, which has many variations, in support of the value concept is that unless the owners of plant are allowed to recoup replacement cost of plant through depreciation charges, capital impairment, sometimes called capital erosion, will result.

"Those who favor the value concept regard depreciation as a means of financing replacements. Emphasis is thus centered on the financial aspects of depreciation. Capital is looked upon as physical property which has a certain capacity for service, which capacity must be maintained by customers without any additional investment on the part of the owners of the business. It is said this result will be achieved if customers pay for depreciation on a value basis."

Noting that there was considerable difference among the proponents of economic depreciation, as to how the adjustment should be made to the current depreciation accruals in order to restate them in terms of value or replacement costs, the report went on to say that "the nub of the economic depreciation argument is that the object of the depreciation charge should be the preservation of the physical integrity of property in terms of service capacity."

The committee made its position clear on the subject of economic depreciation when it stated that "it should be noted that the cost basis is prescribed by all the Uniform Systems of Accounts promulgated by regulatory commissions in this country."

The report went on to say that while the Supreme Court, in United Railways vs West Case in 1930, held that depreciation expense must be based on fair value, the Hope decision by the Supreme Court in 1944 nullified the earlier opinion.

After reciting the difficulties of applying value depreciation because of the uncertainty of future price levels, changes and improvements in technology which would benefit customers, the committee noted significantly "A serious defect of the value depreciation process would be the exaction of an overcharge against present customers. Under the plan, present customers not only would be charged with the capital cost of a new plant item which in fact does not exist, but would also be charged with the operating costs of the old item that continues in service. Thus . . . customers would be charged with hundreds of millions of dollars of fuel costs which would be saved if the plant were modern. This is hardly equitable treatment," the evaluation committee report pointed out.

"The use of index numbers to determine depreciation expense on a so-called value basis ignores one of the nation's outstanding accomplishments —technological advancement. In a sense, the index number method presumes technological stagnation. The method is invalid on this ground alone."

Proper Depreciation Base

In its conclusion, the committee stated that "this committee's re-examination of the question as to what is the proper depreciation base, leads firmly to the conclusion that the claims advanced in support of economic depreciation are lacking in probative force. The committee is convinced that the long-established cost basis is sound, practical and equitable and should be continued."

The NARUC committee report on "Corporate Finance" stated that "continued large capital investments by utilities characterized the year 1953. The total volume of utility financing was larger than any other post-war year, whereas total corporate and railroad financing was less than in 1952."

The report continued "electric utilities in the first three months of the year 1954 issued nearly 50% more bonds than in the like period of 1953, but reduced their preferred and common stock offerings from last year's level.

"Financing for the quarter amounted to $613,637,000 this year against $542,143,000 last year, according to the Edison Electric Institute, which cited Ebasco Services, Inc, as authority for the figures. In the first quarter of 1954 bond offerings increased to $429,850,000 from $289,350,000 a year earlier, while preferred stock financing declined to $58,959,000 from $87,864,000, and common stock to $124,828,000 from $164,929,000," the corporate finance committee said.

The Committee noted that "while the total volume of financing in 1953 was less than in 1952, its character changed little, and in some cases not at all. In each of the previous ten years, except 1952, it was less than for the year 1953. In 1952 public utilities alone went into the capital market in excess of 3¼ billion," the Corporate Finance Committee said.

Rates of Public Utilities

A NARUC committee report on "Rates of Public Utilities" noted that inflation was "obviously still with us. There has not been the same pressure on prices recently, and it may well be that the inflationary curve has flattened out to some extent, but certainly there has been no visible downward tendency.

"Consequently, those utilities which have complained most about the effects of inflation in the past are still most vocal today. The outstanding example of this is, of course, the telephone industry. The very heavy current construction costs seem to affect telephone operations more than those of any other utility, and I think all commissioners present will agree that the Bell System, at least, is anything but lax in presenting its problems in rate cases. There has, so far, been no such general resort to rate increases in the electric industry, though there have also been some important readjustments in this field (See, for example, the outstanding case of re **Commonwealth Edison Co** in Illinois, case Nos. 41,130, etc). This comparative stability of electric rates seems to be due to a combination of factors, e.g., the constantly increasing efficiency of modern large capacity generating units, the flexibility of outside transmission and distribution fa-

cilities and the relatively small labor component in electric costs."

"A large number of ways of meeting the inflationary pressure," the report continued, "have been suggested. These seem to fall into certain categories, each of which has been the subject of substantial debate and study by utility executive and the economic experts, and have been placed before the regulatory authorities. First, there is the elastic rate base. Then, we have the theory of economic depreciation, and the measures proposed to meet the phenomena of the regulatory lag and of inflationary attrition."

Computation of Rate Base

The committee report noted "there have been no outstanding situations during the year which would indicate any change in the philosophies of the various regulatory commissions regarding the computation of the rate base. At the time of the report of your committee last year, there had been significant court decisions in Illinois, (Illinois Bell Telephone Co v Illinois Commerce Commission, 414 Ill. 275, 111 NE 2d 329), Indiana, (Indiana Bell Telephone Co v PSC, 93 PUR (NS) 480, 112 NE 2d 751), and Maine, (New England Telephone & Telegraph Co v PSC, 148 Me. 374, 94A 2d 801), which we then called to your attention. There have been similar significant rulings during the year just past in Rhode Island, New Mexico, North Carolina, and Delaware."

Study of the orders of the various commissions, the report went on to say "discloses no visible tendency in those states which have been committed to the original cost theory to adopt a computed cost basis (i.e. fair value) in order to compensate for the effects of inflation. The Federal Power Commission, of course, remains steadfast in its traditional position. On the other hand, in those jurisdictions which were previously committed to a computed cost rate base, the orders entered during the year have indicated no tendency to modify their position."

The report continued "it must be confessed that the barrage of speeches, articles, and testimony to which the regulatory authorities have been exposed during the past year does not appear to have had very much practical effect. Wherever the matter is discussed by the regulatory bodies in their orders and where there is no

(*Continued on page* 158)

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
Nov. 18	**2.89**	**2.91**	**3.11**	**3.88**	**4.04**	**4.38**	**4.51**	**4.82**	**5.18**
Nov. 11	2.87	2.92	3.10	3.88	4.03	4.36	4.52	4.80	5.19
END OF QTR.									
3rd 1954	2.88	2.90	3.10	3.89	3.99	4.38	4.50	4.80	5.19
2nd 1954	2.90	2.96	3.19	4.03	4.14	4.48	4.72	5.04	5.45
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months	Period Ended	Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Arizona Public Service	12	Sept.	$4,531,000	$3,659,000	$1.47(a)	$1.29(a)
California-Pacific Utilities	12	Sept.	616,190	562,283	2.09(b)	2.03(b)
Carolina Power & Light	12	Oct.	7,853,432	7,259,414	....	....
Central Illinois Light	12	Oct.	3,530,435	3,434,887	3.03(c)	3.26(c)
Cincinnati Gas & Electric, consolidated	12	Sept.	12,289,013	10,948,611	1.64(f)	1.51(f)
Columbus & Southern Ohio Electric	12	Sept.	5,369,295	5,410,703	1.88(g)	2.27(g)
General Public Utilities and domestic subsidiaries only	12	Sept.	20,014,973	16,994,549	2.06(h)	1.75(h)
Michigan Gas & Electric	12	Sept.	454,709	458,569	2.72	2.75
New Jersey Power & Light	12	Sept.	1,918,372	1,303,228	....	....
New York State Electric & Gas	12	Sept.	9,506,851	8,564,655	2.64(i)	2.71(i)

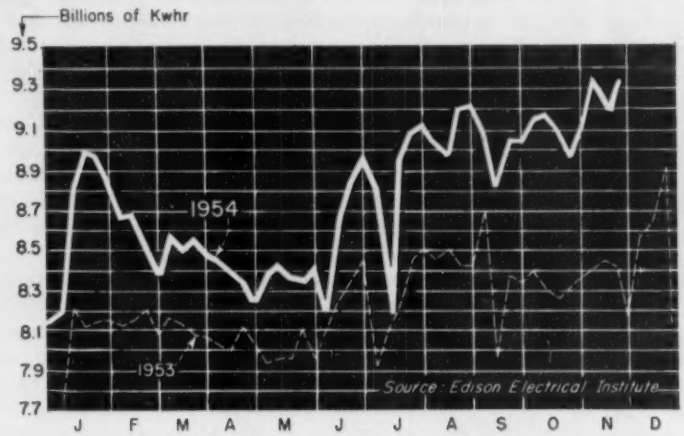
Notes—(a) On shares outstanding at end of period; (b) Based on 232,964 shares in 1954 and 228,536 shares in 1953; (c) Based on one million shares in 1954 and 900,000 shares in 1953; (f) Based on 6,800,000 shares in 1954 and 6,505,000 shares in 1953; (g) Based on 2,401,360 shares in 1954 and 2,001,360 shares in 1953; (h) Based on 9,702,766 shares outstanding; and (i) Based on 3,034,068 shares in 1954 and 2,696,950 shares n 1953.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public / Bid Date
WEEK OF NOVEMBER 18-24			
Preferred Stock			
Black Hills Power & Light—30,200 sh 4.56% $25 par cum	$1,000	$25.50	4.47%
Common Stock			
Virginia Electric & Power—600,000 sh (being offered commonholders on 1-for-10 basis, record Nov. 23 to expire Dec. 8 with an over-subscription privilege)	$17,400	$29.00	4.83%
SCHEDULE FOR NOVEMBER-DECEMBER-JANUARY-FEBRUARY			
Bonds and Debentures			**Bid Date**
Public Service Co of New Hampshire—1st mtg due 1984	$12,000	.....	Nov. 30
Long Island Lighting—1st mtg due 1984	15,000	.....	Dec. 7
New Orleans Public Service—1st mtg due 1984	6,000	.....	Dec. 14
Commonwealth Edison—conv debs	50,000*	.....	Jan. 11
Kansas City Power & Light—1st mtg due 1985	15,000	.....	Feb 15
Preferred Stock			
Interstate Power—200,000 sh $50 par	$10,000	.....	Nov. 30
Central Power & Light—75,000 sh $100 par cum	7,500	.....	Dec. 7
Mississippi Power & Light—44,476 sh $100 par (to be offered in exchange for outstanding $6 pfd on a sh-for-sh basis, plus a cash difference between initial public offering price of new shares and redemption of the old shares)	.....	.....	.....
Patchogue Electric Light—750 sh $1,000 par	750	.....	.....
Public Service Electric & Gas—250,000 sh $100 par cum	25,000	.....	Jan. 11
Common Stock			
Duke Power—218,737 sh (to be offered commonholders on 1-for-20 basis without underwriting)	.....	.....	.....
ISSUES RECENTLY POSTPONED			
Bonds			
Gulf States Utilities—1st mtg due 1984	$24,000	.....	.....
Consolidated Edison Co of N. Y.—1st mtg due 1984	$50,000	.....	.....
Preferred Stock			
Gulf States Utilities—160,000 sh $100 par cum	$16,000	.....	.....
UNSCHEDULED AND/OR UNDER CONSIDERATION			
Bonds			
Connecticut Light & Power—1st mtg	$10,000	.....	.....
Kentucky Utilities—1st mtg	15,000	.....	.....
Duke Power—1st mtg due 1975	40,000	.....	.....
Virginia Electric & Power—1st mtg	20,000*	.....	.....
Preferred Stock			
Public Service Co of Oklahoma—100,000 sh $100 par	$10,000	.....	.....
Southwestern Gas & Electric	6,000	.....	.....
Common Stock			
Kentucky Utilities—about 228,678 sh (to be offered commonholders on about 1-for-10 basis)	.....	.....	.....

Notes—* Estimated.

STATISTICS



Output Week Ended Nov. 20—9,317,000,000 Kwhr

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 20	+10.7	+3.6	+4.9	+8.5	+3.5	+21.7	+10.5	+6.3	+5.8	+7.0
Nov. 13	+8.7	+1.4	+2.5	+4.8	+2.3	+19.1	+11.5	+5.3	+6.6	+7.5
Nov. 6	+11.4	+2.5	+6.1	+7.5	+5.9	+24.2	+11.2	+4.9	+7.3	+8.0

Seasonally Adjusted Index †173.2 Week Ago 172.8 Year Ago 156.6

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load ‡(Million Kw)	Sept.	79.4	79.7	74.4
Capacity (Million Kw)	Sept.	99.16	98.08	87.59
Production (Billion Kwhr)	Sept.	39.55	41.17	37.03
Hydro	Sept.	7.80	8.34	7.59
Fuel	Sept.	31.74	32.82	29.44
Fuel Consumption:				
Coal (Million Tons)	Aug.	9.83	9.40	9.71
Oil (Million Barrels)	Aug.	4.85	4.45	6.54
Gas (Billion Cu Ft)	Aug.	130.49	127.37	112.88
Sales (Billion Kwhr)	Aug.	33.88	32.99	32.82
Residential	Aug.	9.65	9.50	8.48
Commercial	Aug.	6.66	6.52	5.98
Industrial	Aug.	14.89	14.35	15.83
Other	Aug.	2.68	2.62	2.52
Net Income Class A & B Companies ($ Million)	Aug.	89.43	84.44	77.24
Estimated Dec. '54 Peak ‡(Million Kw)	Aug.	88.0	88.1	91.9
Kwhr per Residential Customer (12 Month Average)	Aug.	2,476	2,458	2,287
Revenue per Kwhr Residential Service (12 Month Average)	Aug.	2.71¢	2.71¢	2.75¢
Canadian Production (Billion Kwhr)	Aug.	5.46	5.48	5.09

Business Statistics

FRB Industrial Production Index†	Oct.	129	126	136
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	355.5	356.0	367.2
EW 4 Industry Production Index†	Oct.	116.6	116.0**	124.0
ENR Construction Cost Index†	Nov.	134.8	134.6	128.1
BLS Consumer's Price Index	Sept.	114.7	115.0	115.2
NEMA Insulation Materials Sales Index†	Sept.	123	111	153
NEMA Electric Appliance Sales Index†	Sept.	115	91	102
NEMA Household Refrig. Sales Index†	Sept.	73	71	62
Metal Prices				
Copper, Conn. V., lb		30.0¢	29.7¢	29.7¢
Lead, N. Y., lb		15.0¢	15.0¢	13.5¢
Zinc, prime Western E. St. Louis, lb		11.5¢	11.5¢	10.0¢
Tin, Straits, qual. N. Y., lb		91.0¢	92.9¢	85.3¢
Aluminum, ingot, base price		22.2¢	22.2¢	21.5¢
Nickel, base price		60.0¢	60.0¢	60.0¢
Steel, billets, Pitts., ton		$64.00	$64.00	$62.00
Steel, scrap, No. 1 heavy, Pitts., ton		$34.00	$32.00	$35.00

*Preliminary **Revised ‡Class 1 Systems †1947-49=100 ††1949=100

Consumer's Purse Strings Key Short-Term Outlook

The consumer has returned to the center of the stage as the key figure in the short-term outlook . . . so reports the Federal Reserve Bank of Chicago in its November analysis of the business situation.

Income & savings up . . . Disposable income, despite employment cutbacks, has remained at or near last year's high, thanks mainly to tax cuts and unemployment and pension payments. Liquid savings on hand are larger than ever. With this incentive, manufacturers and merchants will be vying with each other to lure these dollars to market—with the hope of bettering or at least maintaining recent levels of sales and output.

Inventory cuts over . . . Most of the inventory paring that has resulted in the lowered level of productivity in 1954 has already taken place. Total inventories declined by $650 million in July and $260 in August, on a seasonally adjusted basis. This slower rate of liquidation combined with signs of a renaissance in some fields, suggest that the net drop may be at an end.

From September 1953 through August of this year, the total percentage decline in stocks amounted to 5%. Virtually all of this reduction was in durables, however, and the Chicago Bank notes that these were particularly of the type dominant in the midwest.

Steel production up . . . But currently, there has been a rise in the steel rate, from 63% of capacity in July to 74% in October, suggesting that some users were ready to add to their stockpiles again. A moderate step-up in military orders is a part influence here.

Meanwhile, manufacturers in the automobile industry have been accumulating parts and supplies for the production of new models, a situation which has in part offset the reductions in the number of finished cars in dealers' hands.

Now, with the switch-over to 1955 models, auto production is again on the upswing. Moreover, since this switch used to occur later in January or February, the last quarter of this year may well see a more than seasonal spurt in output and general production.

WASHINGTON COMMENT

Industry Awaits AEC Decision on Freeing Data

American industry has demonstrated an intense interest in the investment possibilities of atomic energy. At several recent heavily attended conferences, including the New York sessions of the Atomic Industrial Forum and the National Industrial Conference Board, experts expressed the hopes and fears of government and business. They tried to point the ways best open to development.

Of particular interest to those who guide the nation's industrial financing were the problems still to be ironed out before large-scale development in any area can be undertaken. Problems abound even in the most promising field, that of nuclear electric power generation. One of the chief difficulties is that of declassification of atomic energy information so that it can be made easily available to interested private entrepreneurs.

Up to AEC . . . The new atomic law makes it mandatory on the Atomic Energy Commission to regulate the release of this information. AEC is setting up a program for deciding which atomic data must be kept secret for security purposes and which can be turned loose, and in what way.

This, despite the aid of the military and industrial teams who helped in the early stages of the atomic program, is no easy chore. Not only does industry's future in this field hinge to a large extent on the decisions of a handful of top federal officials; so does the nation's military security, and with it the security of the free world.

So it is that AEC officials charged with sifting through the mass of information and establishing a system of rules to guide its release do not take their jobs lightly. They realize, perhaps more than anyone else, the importance of doing this job correctly. They will resist the pressure being exerted by eager industrialists who want to get their plans underway and cannot move until they have more facts.

Tripartite Accord Reached . . . A group of Americans, including AEC officials, recently came to agreement with the British and Canadians as to what general areas of atomic data can safely be made available to much of the industrial population. The plan is to establish a "gray area" of semi-classified information. This will be made available to firms and individuals who pass a fairly easy security check. It will consist of material lying between the highly restricted military items and those which can be freely released to the public. The provisions of this agreement now guide AEC in its job of writing regulations under which the facts actually will be disseminated to industry.

These are some of the problems being worked on by the agency:

- Much atomic information already has been completely declassified. Most interested businessmen have already exhausted this knowledge and await the availability of "gray area" data. But others, interested but new to the idea of peacetime atomic energy, do not realize the amount of information at their fingertips.
- Classification of future "secrets" must be accomplished under a standardized procedure. This must be worked out with the military.
- An efficient system of disseminating "gray area" material to qualified firms must be worked out so that it will not be necessary for every firm to send its top researchers to every AEC installation containing a semi-restricted library.
- A fair price must be established under the new law, not only for fissionable material made available by AEC, but also for the material produced privately as a result of participation in the program. Prices are so closely related to production that AEC must be extremely cautious to avoid indirect disclosure of secret information.

It would seem that a few federal officials are holding up the nation's progress in the field of peacetime atomic energy. Perhaps they are. But, as one of these officials said a few days ago, AEC cannot rush a job as important as this one. He expressed confidence in those involved in working out solutions, and he called for patience on the part of eager prospective participants in the new industry.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Carrier signal may measure only 10 db lower on the phase wire to which the receiver is inadvertently coupled than on the adjacent phase wire to which the transmitter is coupled.

Bare copper wires for neutral conductors installed in the same duct with lead-sheathed cables in some instances have resulted in severe sheath corrosion.

Conductor galloping is infrequent in summer because a cylindrical body is aerodynamically stable. Ice accumulation destroys the symmetry and fosters galloping.

Boiling of the working fluid directly within the nuclear reactor is believed ultimately feasible by some and that is why the lean toward the aqueous homogeneous reactor.

Rotational energy of the rotor of a modern 3,600 rpm 100-Mw unit is about 6.5×10^8 ft lb at the excess speed at which complete failure will occur.

Zirconium boride has a melting point of 5,345F. Zirconium silicide is as hard as tungsten carbide.

Aromatic ingredients of refined transformer oil are considered to act as natural inhibitors of oxidation, and their retention should be protected as far as possible.

Nickel is an excellent contact material, but unfortunately it is not protective to aluminum galvanically and presents subsurface corrosion problems when plated over aluminum parts.

Radioactive contamination can be removed from nearly all surfaces by washing with two parts of modified sodium hexametaphosphate with one part of soap or synthetic detergent applied in 1% solution in water.

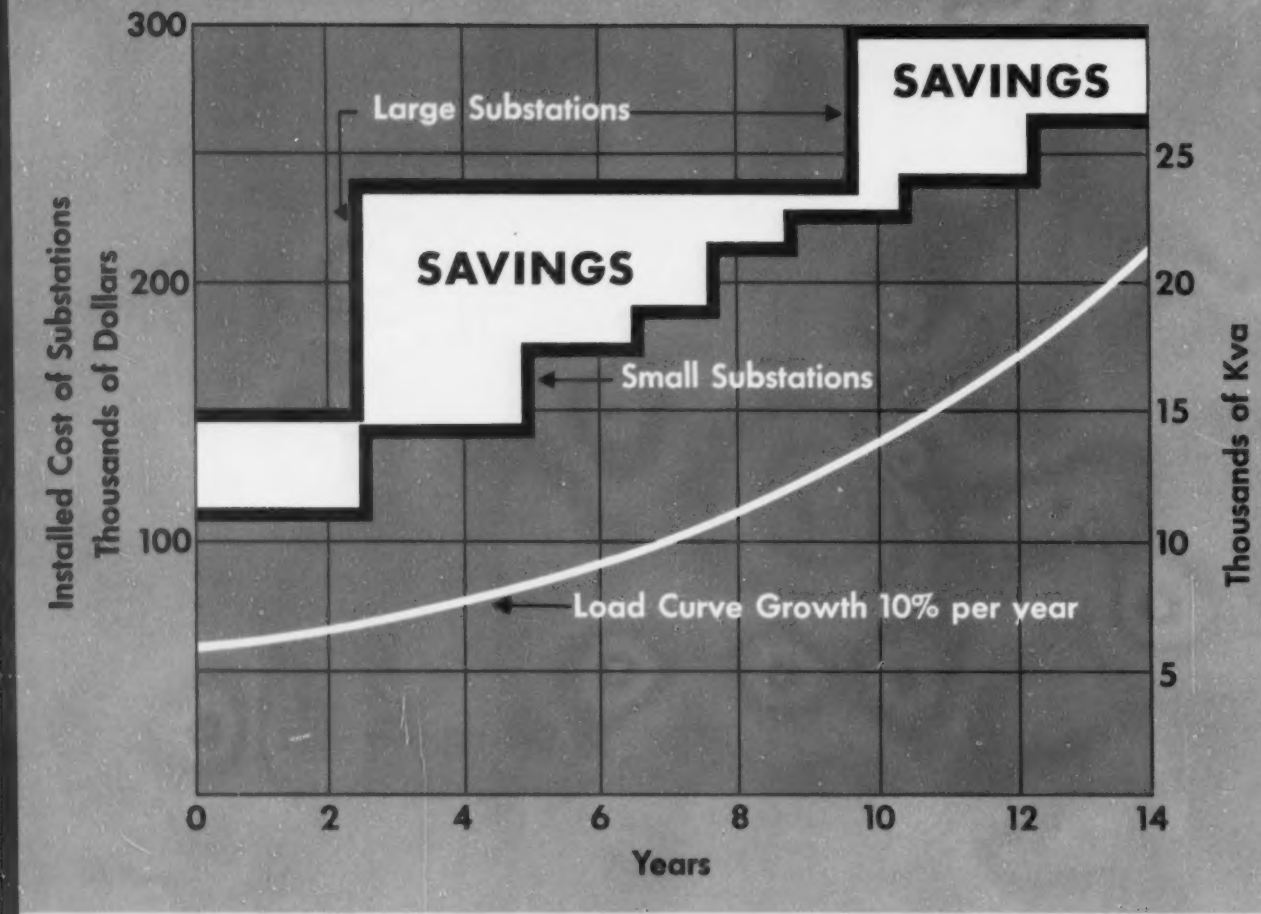
THE CREATIVE LANDSCAPING AND SAFETY FEATURES OF THIS P. G. & E. SUBSTATION PAY OFF IN COMMUNITY GOOD WILL.

P. G. & E. uses unit substations where appearance and safety really count

In residential areas, utilities like Pacific Gas and Electric are faced with the problem of economically meeting load growth with substations which do not detract from the attractiveness of a neighborhood, and which do not present a safety hazard to residents, especially children. General Electric unit substations have helped P. G. & E. meet these requirements.

The smooth compactness of G-E unit substations is designed to upgrade the appearance of neighborhood landscapes. Complete metal enclosures and underground cable connections make them safer even near unsupervised playgrounds. In many cases, this permits installation with consequent savings in areas where conventional substations would be prohibited.

GENERAL ELECTRIC



THE "BUILDING-BLOCK" METHOD cuts costs of meeting load growth. Adding capacity in small "blocks-of-power", by advance ordering of master or package substations for delivery when needed, substantially reduces the overall system investment. This chart shows how the addition of small unit substations, rather than large substations with over-large reserve capacity, creates real savings. This chart assumes that load growth can be predicted accurately. Actually, this is seldom possible. If load growth is erratic, however, savings will generally be even greater. When load unexpectedly drops, the "building-block" system is even more worthwhile, providing insurance against excessive unused power. Unused capacity, in the form of these smaller unit substations, can readily be moved to meet load growth in another area.

BEHIND THE HEDGE and attractive fence is a G-E unit substation which matches the landscaping of surrounding homes. Certainly nothing here detracts from the neighborhood's natural attractiveness.

THIS RUSTIC STOCKADE might easily be a private fence for a modern home in a semi-rural area or suburb. Actually, it is an attractive and inexpensive way of disguising a unit substation by imaginative landscaping.

Why and how P. G. & E. uses factory-assembled standard substations

Factory assembled substations have helped Pacific Gas and Electric Company keep pace with the tremendous post-war load growth on the west coast. The company has standardized on several types of factory-assembled substations, designed to meet specific requirements of its service areas. Their sound ordering policy anticipates future load growth. As the load grows, sites will be selected and these substations will be ready for installation. *Thus, P. G. & E.'s customers will be supplied with the power they need when they need it, efficiently and economically.*

In addition to these basic economic advantages of the "building-block" approach to system expansion, P. G. & E. realizes many other benefits from the use of factory-assembled substations.

Compact units present a very attractive appearance, as contrasted to the patchwork look of substations erected piecemeal in the field. Complete metal enclosure helps protect operators against accidental contact with live parts. Positive interlocks prevent removal of breakers unless they are in open position. Shipped in two or three sections, General Electric unit substations can be installed easily by simply bolting them together and connecting power leads.

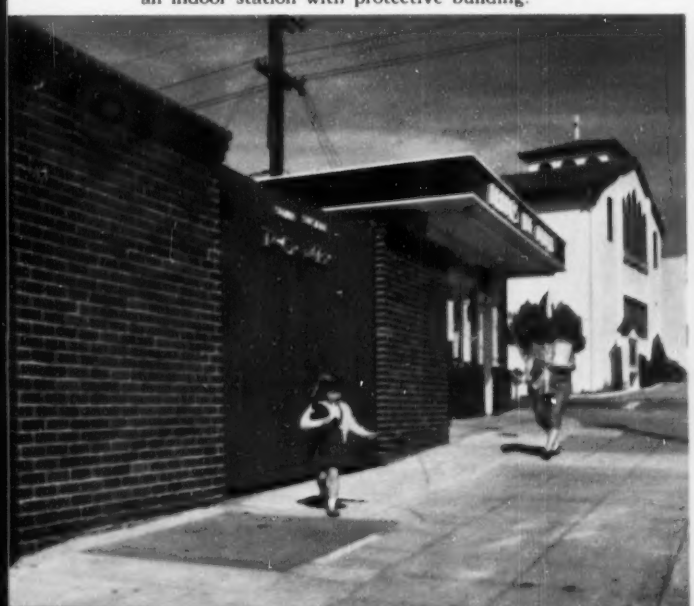
The installed cost is low, and more important, *predictable*. There are no "extras" to buy. Substations manufactured on a repetitive basis assure maximum savings and fastest shipments. Purchasing is simplified because there is only one specification — one purchase transaction. New orders can be placed without further engineering or specification writing.

Conservatively designed for long, dependable service, the unit substation offers over-all service reliability of a high order. As it usually serves a relatively small load area, outages or damage to any of its elements involve only local service disruption and minor expense. Little installation space is required — its compactness permits strategic location close to load.

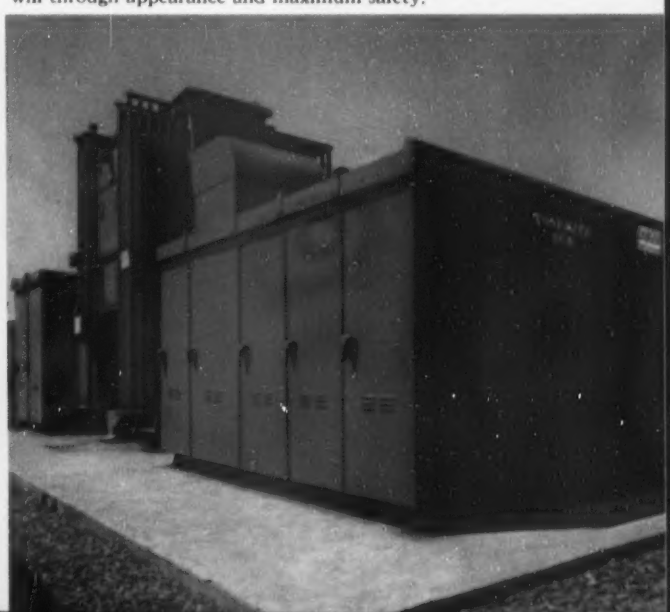
Because master unit substations are basically standard designs, each unit incorporates years of engineering effort. This results in a design that is closer to perfection, and produces coordination impossible to achieve in piecemeal operations.

GENERAL ELECTRIC

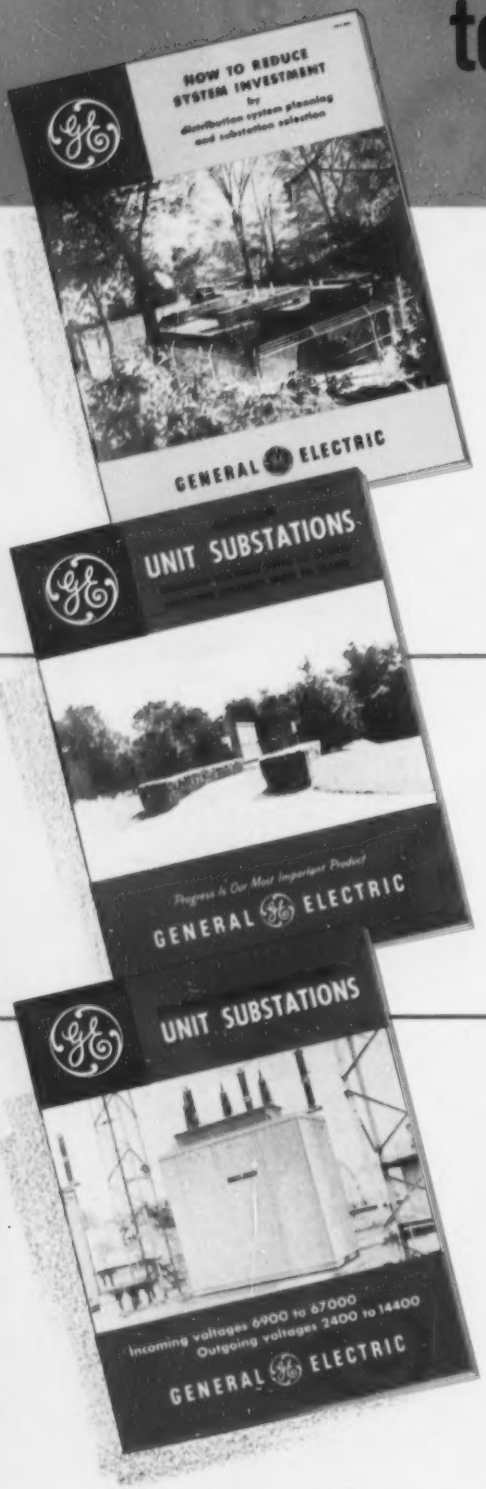
IN THIS COMMERCIAL AREA, a G-E unit substation has been fronted by a simple brick wall which keeps it in character with surrounding buildings. This unit costs far less than an indoor station with protective building.



THIS G-E MASTER UNIT SUBSTATION, rated 4000 kva, is a "standard" unit in P. G. & E.'s program of "building-block" expansion to meet rapidly growing loads. It promotes good will through appearance and maximum safety.



These useful G-E publications explain today's substation story



HOW TO REDUCE SYSTEM INVESTMENT

On a national scale, electric utilities are now spending approximately one billion dollars a year to assure adequate distribution facilities. Since the early 1930's, the distribution system has represented the largest single item of utility investment. This manual shows you how best to face today's constantly mounting construction costs.

For over two decades General Electric has encouraged advance system planning through application of ready-to-install package substations, factory-engineered and factory-built. The building-block approach to system planning is examined in detail as a means of reducing distribution system investment. For your copy, contact your nearby G-E Apparatus Sales Office, or write for bulletin GEA-5847. Address Section 512-1, General Electric Company, Schenectady 5, N. Y.

MASTER UNIT SUBSTATIONS

This publication provides a complete description of G-E Master Unit Substations. It includes a discussion of time and money factors, and describes a variety of high-voltage arrangements. The proven design features of G-E transformers are shown in detail, as well as the maximum protection provided with G-E metal-clad switchgear.

Layouts, weights, dimensions and complete guide form specifications are included. For your copy, contact your nearby G-E Apparatus Sales Office or write for bulletin GEA-3800C. Address Section 512-1, General Electric Company, Schenectady 5, N. Y.

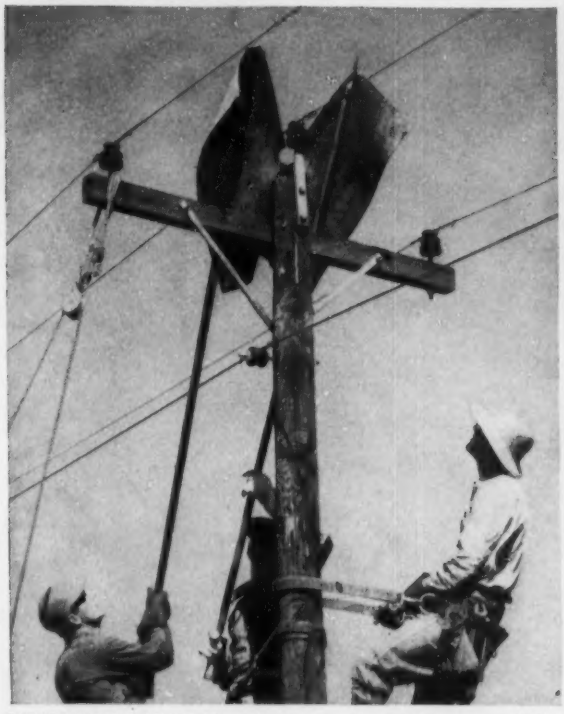
SINGLE-CIRCUIT UNIT SUBSTATIONS

General Electric single-circuit substations of the integral type are particularly applicable to low density areas or small spot loads in the range of 1,000 to 5,000 kva. They are of the single bus, radial feed type. All components are coordinated and assembled within one housing making a single compact unit, ideal for temporary or seasonal loads, suburban areas, new developments, and coordinated load building programs.

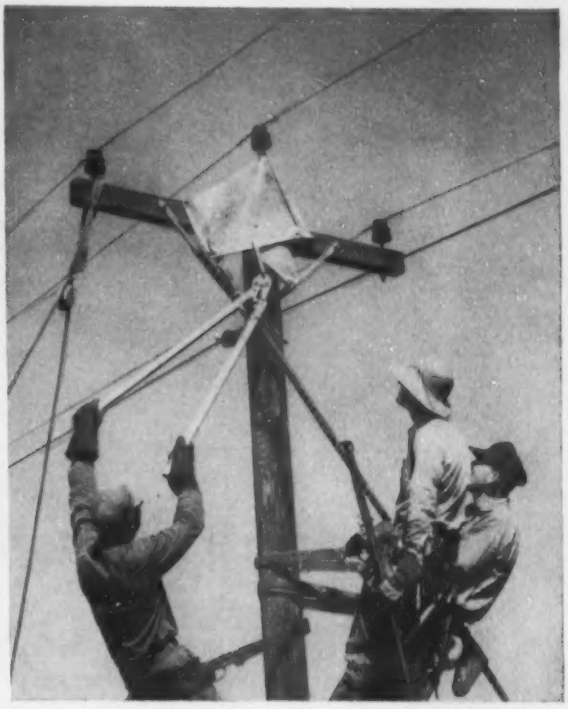
For your copy of the bulletin contact your nearest G-E Apparatus Sales office, or write for Bulletin GEA-4300 and GET-1977. Address: Section 512-1, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



WRAPPING A SPLIT BLANKET around a pole-top pin is accomplished by using a prong-type hot stick and a cotter key puller stick



SECURING THE BLANKET is done with a blanket clamp. On extremely windy days ropes are used to hold the blanket in position

Split Blankets Placed Around Pins Prevent Wire to Hardware Contacts

A. T. BELLER, Engineer, Distribution, Public Service Co of Indiana, Inc., Plainfield, Ind.

Split blankets are finding many uses on the Public Service Co of Indiana system. Old blankets are used for this purpose. They are being used jointly with hot sticks where clearances are close. They are not used for the protection of workmen but to prevent accidental contact between tie wire or conductors and line hardware during hot stick work.

Initial idea was developed for changing insulators on 16-in. pole-top pins on 12-kv lines. Clearances on this construction are close for hot stick work. Changes in design were considered but were rejected.

It was then that Ralph J. Young, safety engineer, working with the hot-line tool training committee, came up with the idea of using the split blanket. They took rubber blankets that had been rejected for rubber goods work and cut a 3-in. hole in the center and a slit running to one edge. Blankets are bordered with yellow paint so that they will not be used accidentally for normal work. Using a prong-type stick and a cotter key puller the blanket is positioned and wrapped around the pole top pin.

The blanket is clamped in place by a blanket clamp. Clamp is held open by a U-shaped piece of No. 4 wire while it is positioned on the blanket with hot wire cutters. The U-shaped wire is then cut, and the clamp closes. On extremely windy days the blanket is held securely with ropes.

Tie wire can then be removed safely and quickly since it isn't necessary to clip the ties while untieing. After the insulator is changed, new standard hot ties are installed; they too can be installed more rapidly without worry or thought of their contacting the pole or braces.

Other jobs for which the split blanket is being used are: In changing out 33-kv pin type insulators on the pole phase, and changing 33-kv insulators on metal arms.

U-SHAPED WIRE holds clamp open during positioning and is cut to close the clamp

Split blanket idea has proved a real time saver on older installations not designed for hot stick work and gives a sense of security to workmen.

(*More How To on page* 102)

NORTH—Shakopee, Minnesota praised the performance of its Form 206 luminaires. The new lights provide superior illumination even in sub-zero weather.

EAST—Central Maine Power Co. accomplished their working objective of providing better street lighting economically by installing Form 206 fluorescent lights at Auburn, Maine.

NEW G-E FLUORESCENT STREET LIGHTS GAIN NATIONWIDE ACCEPTANCE

Are fluorescent street lights practical? Utility and municipal officials who have installed G-E Form 206 fluorescent luminaires are best qualified to give the answer. Their actual field experience, in all parts of the country, is summarized in the following questions and answers.

WHY USE FLUORESCENT STREET LIGHTING?

Fluorescent street lighting provides better visibility and a more even light distribution than the best engineered systems of either filament or mercury lamps. The low brightness of the light source reduces the glare and eye strain that accompanies other types of street lighting.

IS VISIBILITY IMPROVED?

Yes. Many lighting experts believe that fluorescent street lighting increases actual visibility by about one-third. Thus, a 1.25 footcandle level from a Form 206 fluorescent luminaire seems to provide the same visibility as a 1.7 footcandle level from filament or mercury luminaires.

IS THE COLOR OF THE LIGHT PLEASANT?

Yes. The whiter light furnished by the fluorescent lamps does not distort the familiar coloring of objects and people. Businessmen find that shoppers even come from outside usual trading areas to shop under the comfortable light from the fluorescent luminaires.

IS THE SIZE OF THE LUMINAIRE A PROBLEM?

No. The Form 206 luminaire is only slightly over six feet long and the distinctive size and shape add functional beauty to the appearance of any street or roadway. No guys or trusses are required to support the luminaire even in high winds.

WHAT MAINTENANCE IS REQUIRED?

Maintenance is reduced! The fluorescent lamps used in the Form 206 have an average lamp life of 7500 hours, or about two years of street-lighting operation. The hinged plastic globe is shatterproof and is tightly sealed to prevent dirt or insects entering the unit. Sun, rain, heat, cold, or aging do not adversely affect the plastic globe or the light output.

HOW DO COSTS COMPARE?

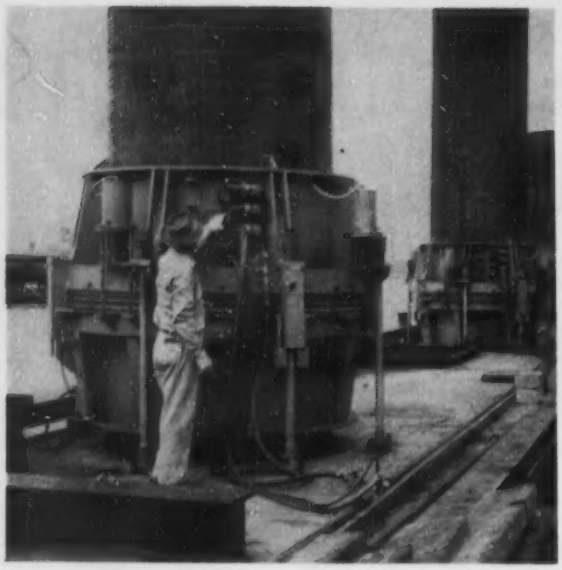
When over-all lighting costs are computed on an equivalent visibility basis, G-E Form 206 fluorescent luminaires cost less than any other comparable system of filament or color-improved mercury. Although equipment and amortization costs are somewhat higher, installation costs are comparable, and operating costs are generally lower.

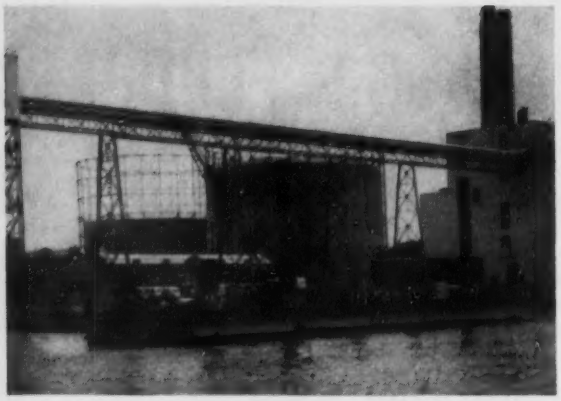
GET MORE INFORMATION about this outstanding G-E fluorescent luminaire, the Form 206. Contact your nearest G-E Apparatus Sales Office, or write Section 452-139, General Electric Company, Schenectady 5, N. Y.

SOUTH—Statesville, North Carolina installed 104 Form 206 fluorescent street lights and was enthusiastic about their visual comfort, economy, and modern appearance.

WEST—Virtually glareless illumination and an even light pattern resulted when Seattle installed Form 206 luminaires to light the second level of this new Alaskan Way viaduct.

GENERAL ELECTRIC





DOCK was floated to final location and steel caissons dropped. Two are shown before drop. Dock was raised eight feet in 85 min

AIR JACKS are used to lift dock to within 1/32 in. of desired location. They are operated from a central panel or individually

"Climbing" Dock Installed for Coal Handling at Astoria

A "new look" was added to New York City's harbor when a coal dock was "planted" at Consolidated Edison's Astoria generating station.

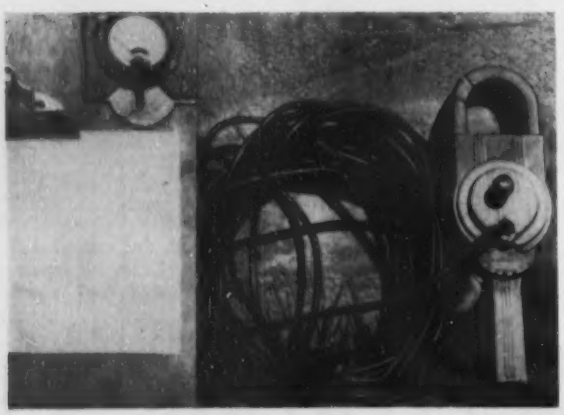
The dock is a steel barge pierced by cylindrical steel sleeves. Steel caissons, 6 ft in diam, are lowered through the sleeves until they reach bottom. The barge is then made to "climb up" the caissons by means of special double-acting pneumatic jacks working on each caisson. Caissons become the piles of the finished dock.

Heart of the dock is the special jacks. A jack consists of retractor mechanism and upper and lower pneumatic grippers separated by bellows. The gripper is a steel cylinder inside of which is a rubber tube. Tie rods connect the upper gripper with the dock. Thus any vertical movement of the upper gripper results in a similar movement of dock. Lower gripper is 6 in. above the dock.

In order to make the dock "climb" the air jack is gripped to the caisson by inflating the lower gripper. Upper gripper and bellows are deflated. While the caisson is held by the lower gripper, the bellows are inflated. This raises the upper half of the jack 6 in. and, thus, raises the dock by means of the tie rods. The caisson is now held by inflating the upper gripper. The lower gripper is next deflated. Then the bellows are deflated. This action automatically inflates the retractor jacks thereby raising the lower gripper. Inflating the lower gripper and deflating the upper gripper returns the jack to its initial position. It is now ready for the next "climb."

This particular dock is in two sections, each 234 ft long and 60 ft wide. Twelve caissons are used with each section. The completed dock, which will support a coal unloading tower, will be long enough for a fuel collier.

Caissons for this dock are lowered into pockets blasted in the rock ledge. After the dock has been raised to the planned height, the caisson will be grouted in place. When the grout has dried pins will be driven into the rock. Then the caissons will be filled with concrete. Cathodic protection and paint will be used to prevent corrosion.



LOAD-CHECKING SET consists of a clamp-on ammeter connected to a meter on clip board by a 50-ft cord to facilitate measuring load

Modified Clamp-On Ammeter Speeds Transformer Checks

ROY G. ATKINSON, Electric Distribution Engineer, Public Service Co of Colorado, Denver, Colo.

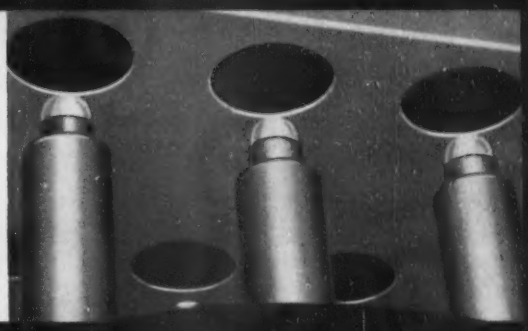
Field checks of overhead distribution transformers may be made faster and with greater ease by adapting a clamp-on ammeter for two-man use. The equipment simplifies the job for the lineman on the pole and pro-

(*Continued on page* 106)

4 reasons why G-E vertical-lift design is best for metal-clad switchgear

1 Allows you to see breaker disconnect

With General Electric's vertical-lift breaker, you can actually *see* that the circuit breaker is disconnected. You don't need to depend on an indicator and when the breaker is disconnected, mechanically operated shutters in metal-clad switchgear automatically close off these stationary disconnect openings to protect the operator.



2 Simple to inspect and maintain

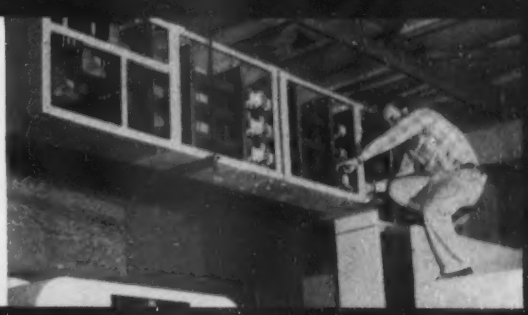
While G-E breaker is still in the compartment, you can make most check tests and even perform some maintenance. Although removal of breaker element is relatively easy, inspection in the compartment saves considerable time and effort.

3 Saves time and energy

In G.E.'s vertical lift design air circuit breakers rated 100 MVA and larger are lowered and raised effortlessly by a simple, fast-acting elevating mechanism, consisting of two jack screws and a sturdy, compact gear-motor. You do away with jacking and cranking. Just set switch for "raise" or "lower" and hold clutch lever forward until breaker is in position.

4 Assures maximum safety

When you need to work on a feeder, you want to be sure that the breaker is disconnected. With G-E vertical lift, you can lower breaker until you *see* contacts disconnect, padlock the mechanism so breaker cannot be raised, and close compartment door. You can then work without fear that someone will carelessly close the breaker and energize the feeder. General Electric Company, Schenectady 5, N. Y. 311-1



Progress is our most important product

GENERAL ELECTRIC

READY TO START moving the 750-kva General Electric network transformer, with submersible protector, from trailer to vault. Notice the room air-conditioning units in the windows—one of the reasons why more capacity is needed here.

Potomac Electric, Washington, D.C., installs G-E network unit to meet extra-heavy load demands

System reinforced with 750-kva G-E transformer and network protector

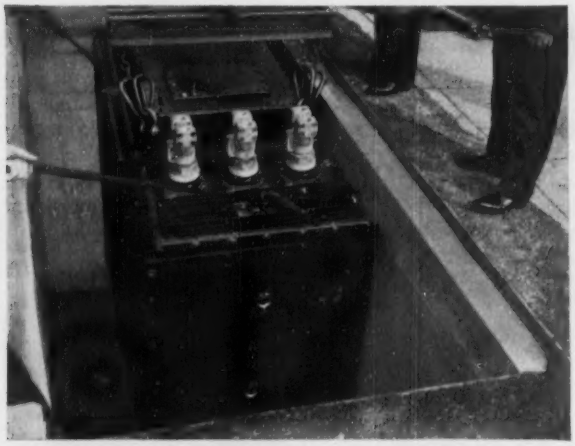
The flexibility and ease of expansion provided by a secondary network system certainly "pays off" for Potomac Electric Power Company in downtown Washington, D. C. Flexibility of the system permits load growth additions with minimum interference to service in the highly concentrated downtown area.

The financial district is experiencing a phenomenal growth and the consequent heavier load requirements, including air-conditioning in existing buildings in the area, necessitated installation of this 750-kva G-E network transformer. The unit, equipped with a submersible automatic network protector, is located at 730—15th Street, N. W., directly in front of the American Security and Trust Company building.

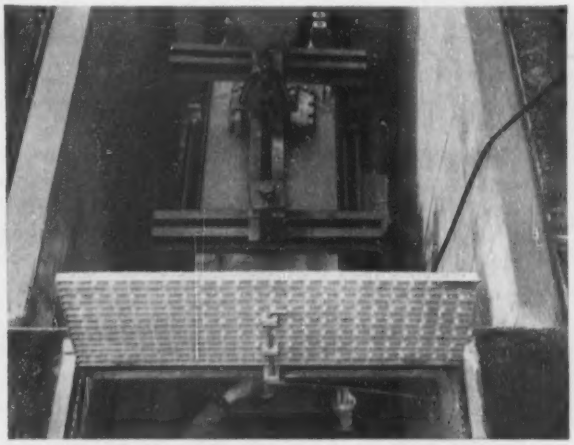
Compactness of G-E network units permits minimum vault depth (7 feet to roof slab) for lower installation cost.

It pays to start a network. Although the change from a radial to a network system means substantial initial expense, future increases in capacity require less investment with a network system. With a growing load, the sooner the network system is started, the lower the ultimate cost. Why not investigate the advantages for your system?

For help in solving your network problems, and for complete information on the many advantages of G-E standardized network units, get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5024, General Electric Company, Section 431-201, Schenectady 5, N. Y.



ALMOST IN PLACE and with minimum inconvenience, even in a congested downtown area. Note the G-E submersible automatic network protector on the low-voltage end of the transformer.



CENTERING UNIT in vault prior to cabling. Convenient location of cable terminals on G-E units makes minimum size vaults practical—simplifies connections for fast installation.

Progress Is Our Most Important Product

GENERAL ELECTRIC

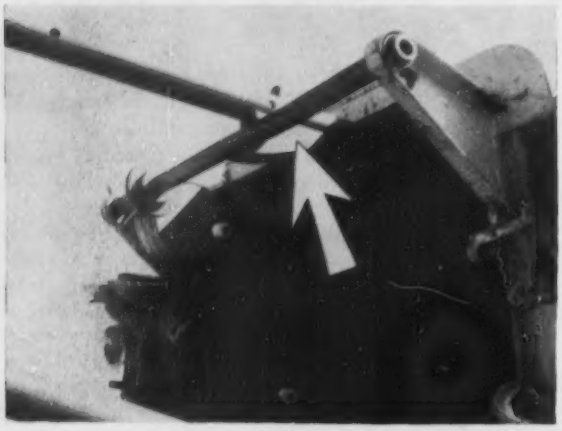
Modified Ammeter

(*Continued from page* 102)

vides an easier and more accurate method for reading transformer load.

Equipment consists of a clamp-on ammeter modified by the addition of 50 ft of extension cable between the clamp proper and the indicating ammeter. The cable is plugged into the clamp with a wood mount that has terminals for contacting the proper points in the meter hole. The ammeter is mounted on a clip-board that also holds the route and test sheet.

Although two men could make the checks, Public Service uses a three-man crew consisting of two linemen who climb alternately and an engineer who acts as recorder and driver. Actual unit costs of checking over 5,300 transformers annually come to 0.16 man-hours or $1.26 per transformer. This figure includes transportation, meals, and overtime incurred as tests are made between 4:30 PM and 8:30 PM.



HOOK on center leg holds derrick in lowered position while truck is traveling. If derrick slips while in use, the hook stops its fall

Hook Holds Derrick in Lowered Position

E. W. BADER, Idaho Power Co, Boise

A hook on the center leg of the A-frame derrick permits line trucks of Idaho Power Co to travel with the derrick in a lowered position without straining cables or any part of the winch. Need for dismantling the A-frame is eliminated if overhead obstructions are to be cleared or rough roads negotiated . Furthermore, the hook will catch on the crossbar and stop the derrick should it fall from a raised position.

Hook is attached to center leg with a ¾-in. keyed pin. In traveling position it engages the cross bar across the end of the truck. The hook prevents the derrick from bouncing sideways as well as up and down during transit.

Hinged Boom Folds to Reduce Overhang from Trucks

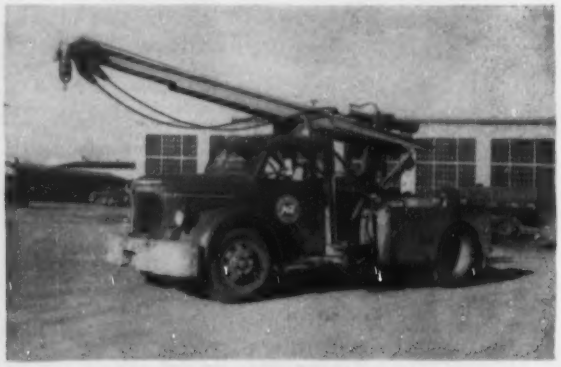
IRWIN W. RIPLEY, Supt of Automotive Equipment, Portland General Electric Co, Oregon

By designing a boom that folds over itself, Portland General Electric Co adapted a hydraulic crane to a truck of short wheel base that meets overhang restrictions in Oregon. The crane has a maximum capacity of four tons and can reach out with extensions to 42 ft through a full circle of rotation. In folded position, the crane meets the front overhang limitation of 3 ft. Redesign of the truck cab allows one man to operate the crane and truck simultaneously.

Main feature of the crane is a hinged A-frame boom that folds almost flat over the cab. The boom consists of sections of 6-in. steel channel with internal 6-in. steel braces between the legs. It is hinged at a point 36 in. from where the legs are at-

(*Continued on page* 114)

IN WORKING POSITION the boom may be rotated through a full circle. It has a four-ton capacity and a reach of 42 ft with extensions



IN TRAVEL POSITION the boom folds over the hydraulic cylinder that positions it. Folding and unfolding is aided by two light cables

One of many advantages of 90/10 Cupro-Nickel

WELDABILITY

Welding head on filter shell

One of the relatively new copper base alloys is 90/10 Cupro-Nickel, which is coming into increased use as a result of experience with it. Revere offers it in sheet and plate, pipe and tube. It is highly resistant to corrosion and erosion, particularly in salt or brackish water. In addition it can be cold or hot worked, welded, soldered and polished. Because its nickel content is less than the older 70/30 alloy, it is priced lower.

The item shown here is a 90/10 Cupro-Nickel filter for aviation gasoline, designed and fabricated by the Warner Lewis Company, Division of Fram Corporation, Tulsa, Oklahoma, for the U. S. Navy. Heads and shell are 1⅛" thick. Revere was given the opportunity to collaborate with the Warner Lewis manufacturers on welding, which was successfully accomplished by the metallic arc process, using Inco 70/30 Cupro-Nickel electrodes. The vertical weld on the shell was X-rayed 100% and found satisfactory to pass Navy inspection. Because of the thickness of the metal, it was decided to form the heads hot at around 1690° F. The forming was done by the Hackney Iron & Steel Co., Enid, Okla., which also consulted with Revere.

Warner Lewis Company of Tulsa, with representatives in 30 cities, are specializing on all types of alloy design and fabrication and inquiries of this nature are invited.

If you wish information regarding the selection, welding, or working of copper and its alloys and aluminum alloys, see the nearest Revere Sales Office.

Completed aviation gasoline filter, made of 90/10 Cupro-Nickel

REVERE

COPPER AND BRASS INCORPORATED

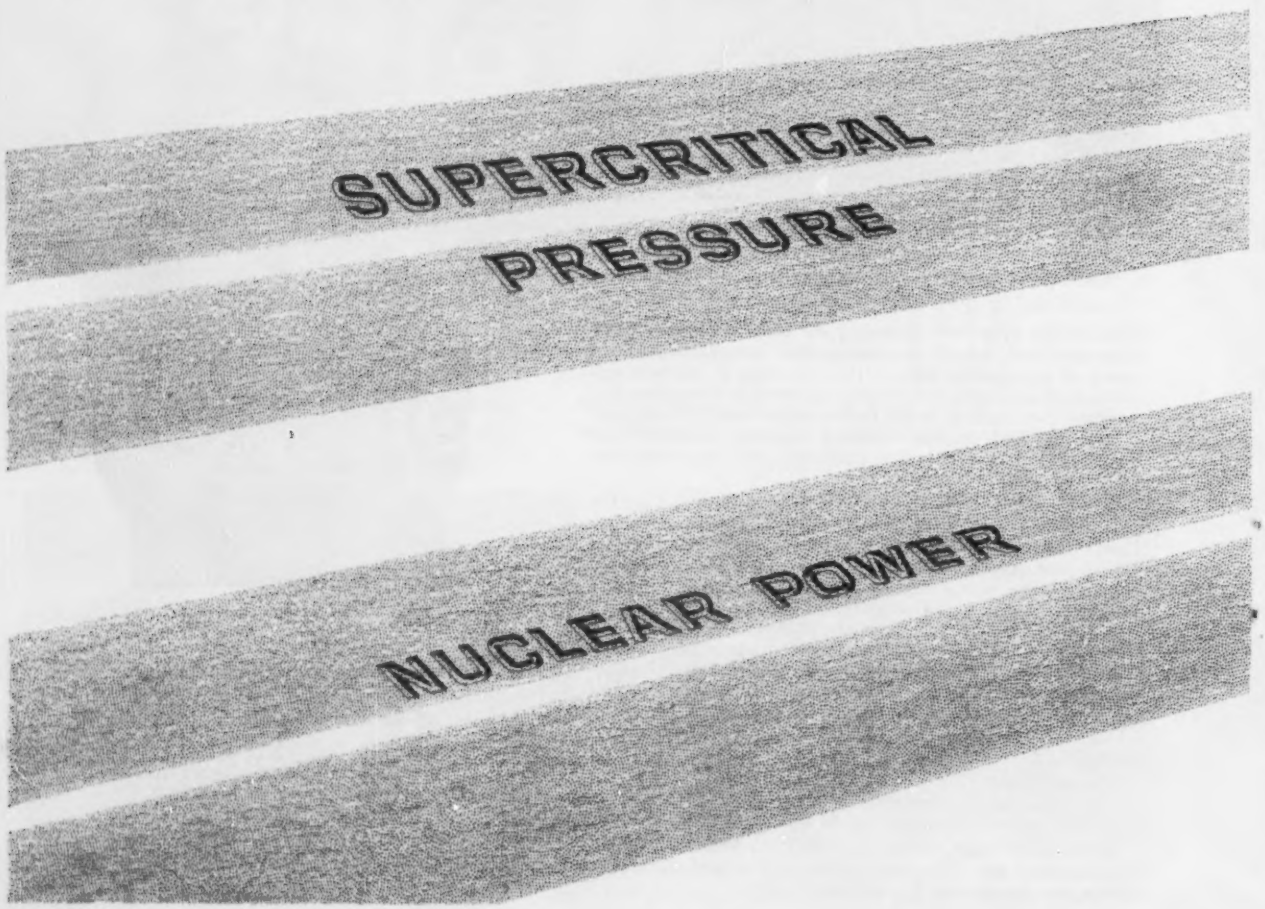
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

new HIGHWAYS to power progress



It seems especially fitting that the two most notable power projects of our times should have been undertaken in 1954 – the year of Light's Diamond Jubilee. These projects are:

World's most efficient power plant. To be built by Philadelphia Electric Company, this new station will have a turbine-generator unit rated at 275,000 kw – the largest ever ordered – which will receive steam at 5,000 psi throttle pressure and 1200 F (initial operation will be at 1150 F). The expected heat rate at initial conditions is 8400 Btu per kwhr. The steam generating unit will be furnished by Combustion Engineering and will supply steam to the turbine at the highest pressure and temperature of any existing or projected power plant in the world. It will be a C-E Sulzer Monotube Steam Generator of the super-pressure "once-through" type, using forced circulation. Maximum design conditions are 6,000 psi and 1200 F, with double reheat, both stages at 1050 F.

America's first nuclear power station. To be built and operated by the Duquesne Light Company, this will be the first U. S. commercial-size nuclear power station. The heart of this plant – the giant pressure vessel that will house the reactor – will be manufactured by Combustion Engineering for the Westinghouse Electric Corporation, which has the A.E.C. contract to build the reactor. This vessel, one of the heaviest-walled vessels ever made, will contain an atomic core of more than 10 tons of enriched uranium. While substantial effects of nuclear power on our economy may not be felt for the next decade or two, Combustion through its Nuclear Power Division, is carrying on extensive development in this field, looking toward the day when power from the atom will be commonplace rather than revolutionary.

• • •

Combustion Engineering, associated with many of the installations that have made power history during the past three decades, takes special pride in the important part it will have in these two most notable projects of the new power era.

C-E

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N.Y.

B-785A

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS, SOIL PIPE

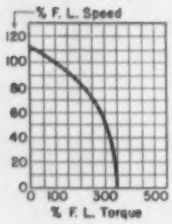
Torque Characteristics of Shunt, Series and Compound-Wound Motors

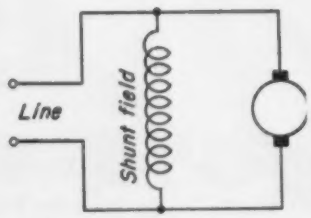
(Fractional HP Motor Sizes for Blowers and Fans)

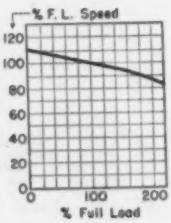
Typical speed-torque curves, connection diagrams, and speed-load curves for the direct-current motors for both direct-connected and belt-driven blowers and fans.

T. E. M. CARVILLE, Small Motor Division, Westinghouse Electric Corp, Lima, Ohio

Shunt-Wound Motors—1/20 to 1/8 Hp

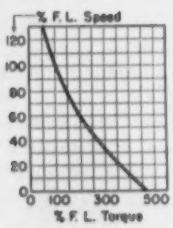


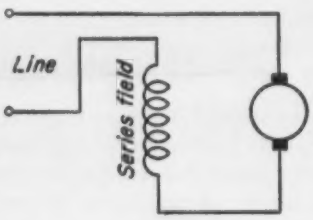


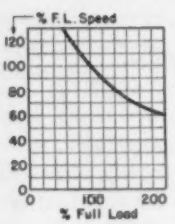


Note: Starting torque is comparatively low. Motor has slight drop in speed with load.

Series-Wound Motors—1/200 to 1/30 Hp

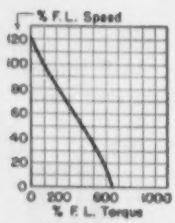


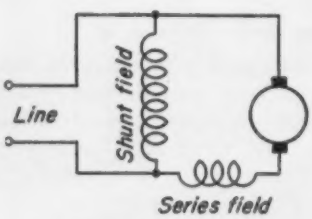


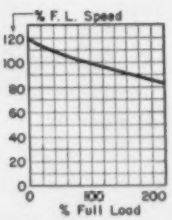


Note: Starting torque is high. Speed is variable, decreasing with increase in load.

Compound-Wound Motors—1/6 to 3/4 Hp







Note: Starting torque is quite high. Speed is nearly constant at normal loads.

Speed-torque curves in left-hand column are for the complete range from no load to zero speed.
Speed-load curves (designated speed-torque) in right-hand column are for operation from zero load to 220% of full-load torque.

Torque information for split-phase, capacitor-start and repulsion induction motors was published in EW, Nov. 1, 1954, page 106, and information for split-phase, permanent-split capacitor and shaded pole motors appeared in EW, Nov. 15, 1954, page 146.

0.1 to 1,000,000 megohm range

GR® Megohm Bridge

The Type 544-B Megohm Bridge is a combination wheatstone bridge and sensitive vacuum-tube voltmeter which makes possible the accurate measurement of resistances as high as 10^{12} ohms. Resistance values are read directly from a dial and multiplier switch, so that measurements can be made quickly and conveniently. The effective scale length for the range between 100,000 ohms and 10,000 megohms is 35 inches. Logarithmic dial calibration gives constant fractional accuracy, regardless of setting.

This instrument is compact and easy to operate. It is available in battery-operated or ac-operated models.

Range: 0.1 to 1,000,000 megohms

Accuracy: ± 3% on 0.1, 1 and 10 multiplier settings; ± 4% on 100 and 1000 multipliers; above 10,000 megohms, accuracy is that with which dial can be read

Insulated Terminals: all high voltage terminals insulated for protection of operator

Guard Terminals: permit determination of resistance between two terminals of multi-terminal "unknowns" such as multi-wire cables and multi-circuit transformers

Power Supply:

A-C Power Supply — operates from 105-125 volt (or 210-250 volt) 40 to 60 cycle line — internal test voltages of 100 and 500 volts, dc available for application to unknown

Portable Battery Power Supply — supplies 90-volt, dc test voltage

Test Voltages are held constant regardless of unknown resistance insuring proper measurement

External Bridge Voltages: terminals provided so bridge can be supplied from external source

Dimensions: 8½ x 22½ x 8 inches

Net Weight: 26¾ lbs with a-c power supply; 29½ lbs. with batteries

Measures:

Insulation Resistance of generators, motors, transformers, household appliances, capacitors, rheostats, cables and slabs of insulating materials

Resistance of deposited-carbon resistors, boro-carbon, palladium-oxide, cartridge-type and other high-valued resistors

Volume and Surface Resistivity of plastics and other solid and liquid dielectrics

Leakage Resistance of Capacitors

Dielectric Absorption (or interfacial polarization) of insulation

Moisture Absorption of various materials

Insulation resistance of electrical machinery varies with age, voltage, moisture content and other physical factors. Periodic measurements give an indication of the condition of such equipment and insure against failure in operation. The Type 544-B Megohm Bridge is widely used by both manufacturers and users of electrical machinery, wire, and other equipment using insulation to perform resistance tests as outlined in ASTM Methods D257-52T. Hundreds of models have been used for years in research laboratories and educational institutions. Insurance companies find this instrument useful in inspection.

Type 544-BA Megohm Bridge . . . with a-c power supply $340
Type 544-BB Megohm Bridge . . . with battery power . . $250
Prices shown are NET, f.o.b. W. Concord or Cambridge, Mass.

GENERAL RADIO Company

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ADMITTANCE METERS
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MEGOHMMETERS
MODULATION METERS
MOTOR CONTROLS
NULL DETECTORS
OSCILLATORS
PARTS & ACCESSORIES
POLARISCOPES
PRECISION CAPACITORS
PULSE GENERATORS
R-L-C DECADES
R-L-C STANDARDS
SIGNAL GENERATORS
SOUND & VIBRATION METERS
STROBOSCOPES
TV & BROADCAST MONITORS
U-H-F MEASURING EQUIPMENT
UNIT INSTRUMENTS
VARIACS
V-T VOLTMETERS
WAVE ANALYZERS
WAVE FILTERS

"Dated" instruments drain away dollars

Instruments can become outmoded . . . just like automobiles and ideas. Progressive instrument development is constantly making many older designs obsolete . . . and such obsolescence can be a steady drain on profits.

Modern instruments save money

Honeywell engineers are proving this fact every day—in a growing number of plants, on all types of processes. Where out-of-date controls have been replaced by modern Honeywell instrumentation, economy-minded engineers and management men have really opened their eyes. And with good reason, for—

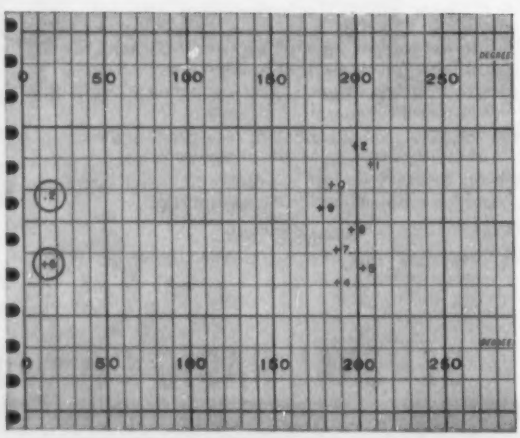
- Modern Honeywell instrumentation saves labor. Centralized control, automatic time-cycle systems, and other recent control concepts save countless wasted steps . . . reduce routine man-hour expenditures.
- Modern Honeywell instrumentation cuts maintenance costs. It affords longer, uninterrupted operation . . . is designed for easy service . . . requires minimum attention.
- Modern Honeywell instrumentation reduces rejects. It maintains the tighter process tolerances demanded by today's more exacting specifications.
- Modern Honeywell instrumentation improves product quality. Precision measurement and control remove any chance of error or guesswork in critical processes.
- Modern Honeywell instrumentation makes cost accounting more accurate than ever before. Everything is a matter of record.

An investment that really pays off

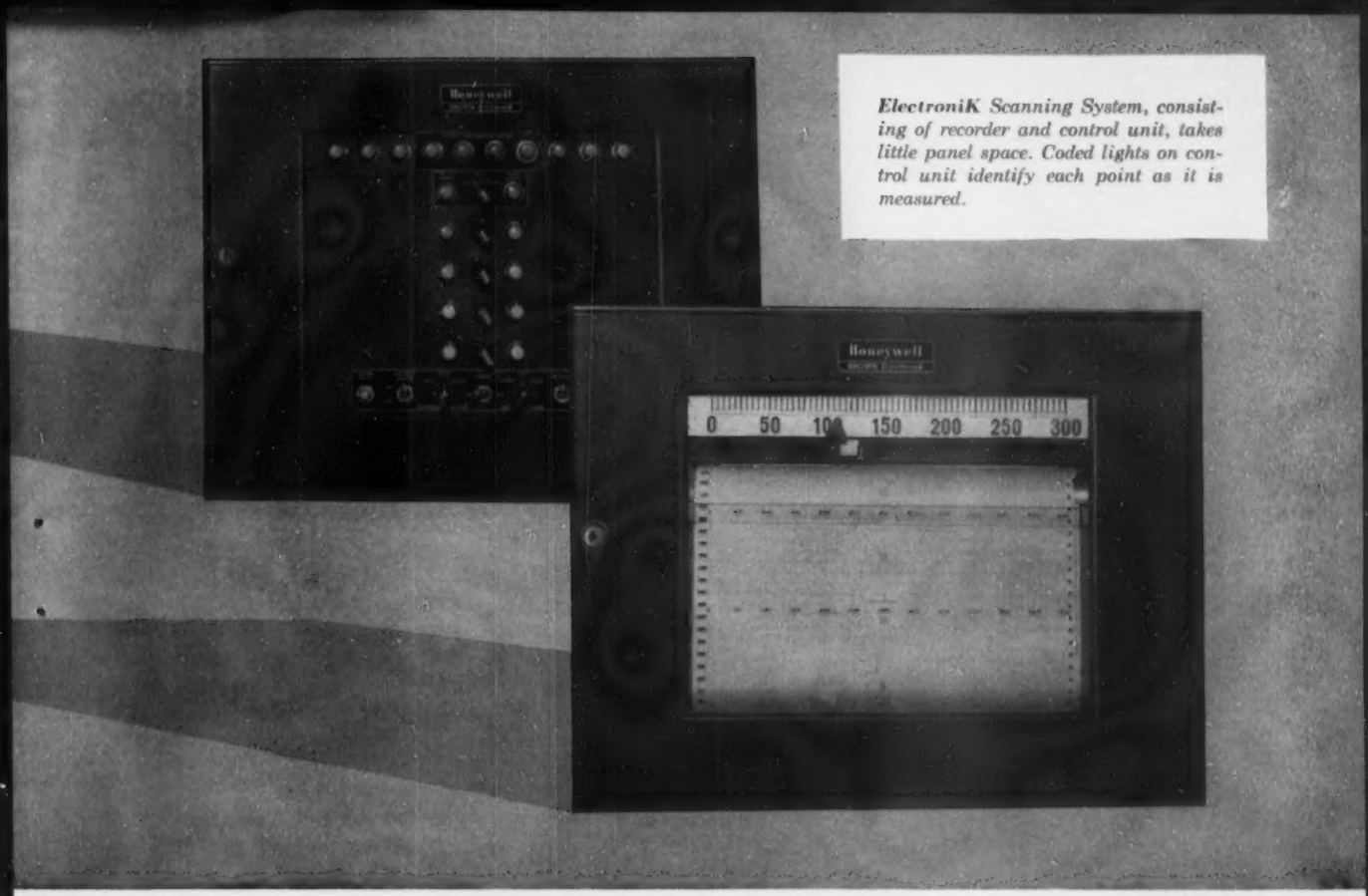
Just being "instrumented" is not enough. You can get more out of your instrument dollar, from both a product and service standpoint, with Honeywell instrumentation . . . the ultimate in engineering and design . . . insurance for your equipment investment.

Replacing with Honeywell is one of the best ways to invest your modernization appropriation. A Honeywell application engineer will gladly survey your present plant instrumentation . . . give you a practical recommendation that will make dollars and sense. Give him a call . . . he's as near as your phone.

This economical, versatile system monitors up to



Sample chart shows how all 270 points are clearly identified on the record.



ElectroniK Scanning System, consisting of recorder and control unit, takes little panel space. Coded lights on control unit identify each point as it is measured.

270 plant temperatures

THE TIME, expense and uncertainties of periodic tours to check temperatures at potential "hot spots" in the plant can be materially reduced by the *ElectroniK* Scanning System. This instrumentation makes temperature monitoring completely automatic and efficiently centralized. A single instrument watches 270 different temperatures in bearings, oil lines, boiler tubes, pumps . . . anywhere you can install a thermocouple.

Because of its exceptionally large capacity, the *ElectroniK* Scanner does the work of up to 16 old-style instruments . . . affords effective overheat protection at low cost per point.

It's fast—scans through successive thermocouples at speeds up to one second per point. Each point is checked at 4½ minute intervals . . . far more frequent than the best manual checks.

It signals overheat. Annunciator contacts are actuated whenever any point in a bank of nine exceeds a preset limit. Different limits can be set for each bank.

It's versatile. At the flick of a switch, the operator can choose:

1. Continuous recording of all 270 points, with positive identification of each.
2. Recording of only those points which exceed a preset limit.
3. Continuous scanning without recording.
4. Selective recording or scanning of pairs of nine-point banks.

Models with less than 270 points are available to meet your individual needs. Your nearby Honeywell sales engineer will be glad to discuss your own plant's requirements . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Data Sheet No. 10.0-9, "*ElectroniK* Scanning System."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Hinged Boom

(*Continued from page* 106)

tached to the revolving platform. The boom is folded over from working position with the hydraulically-operated cylinder and positioning cables.

It is lowered into final traveling position and raised into working position by two ½-in. cables that attach to the hinge pin by sheaves. These cables are controlled by a winch on the platform. Ends of the hinged portion are locked to the stationary legs by eye bolts when the boom is in working position.

In changing the boom from working to traveling position, the operator points the crane over the cab. Locking eye bolts are removed and the winch pulls the lower portion of the crane toward the rear to fold the boom and level it on the mount over the cab. The boom is secured for travel by a turnbuckle.

In redesigning the truck cab the back was enlarged, and side and rear sloping windows were added to extend operator visibility. An extra seat, from which the crane is operated, faces the crane controls to the rear. From this swivel seat the operator also can operate the truck through extra foot pedals for clutch and brake. The gear shift and steering wheel are at his right elbow. An extra throttle control is on the left, along with the winch levers and hydraulic controls for the crane and outrigger jacks.

Two jacks are located on each side of the truck, one just behind the cab door and the other at the rear corner of the body. Jacks fold out to about 3 ft from the truck to stabilize the crane.

In addition to the original extension for the crane, the PGE crew built an 11-ft unit.

CANISTER IN TRUCK stores rod heater units of sizes shown without wooden backing. Canister is made of galvanized gutter downspout by soldering plate over one end and fitting other end with a cap

Canister Stores Wrap-Around Heaters in Service Trucks

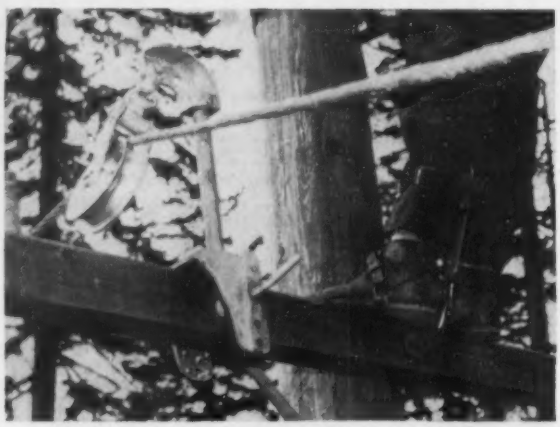
A. B. BEHELER

J. T. WILSON, Appliance Service Dept, Appalachian Electric Power Co, Fieldale, Va.

Service on electric water heaters equipped with "wrap-around" heating units has been expedited by storing an adequate supply of all sizes in a 5½-ft x 3-in. canister mounted horizontally inside appliance-service trucks. Heating units are stored straight so they can be easily installed and are readily accessible. Different-length units are held together by friction tape so the short ones are easy to reach. The canister does not obstruct storage of other service equipment.

The simple canister has a construction and installation cost of $2 for material and 4 man-hours of labor during inclement weather. It can more than pay for the over-all cost even if it eliminates only two trips back to service headquarters for the proper heating element.

Such time-consuming trips were frequently necessary before applying this idea. Even though a district service headquarters may be at the center of the district, the rural territory extends miles beyond the center. When a housewife called for water-heater service, naturally, she is not always able to specify what part needed repair or replacement. Handling of such calls was complicated because both immersion and wrap-around heating elements of different sizes are used.



Block Prevents Damage to Al

Aluminum conductor for distribution lines may be strung without damage using a new stringing block developed by Puget Sound Power & Light Co, Seattle. The device is designed to handle wire above crossarms with pin-type construction at tangents and corners.

The block consists of a wide-flange pulley mounted on an arm through a universal ball-and-socket joint. The arm is attached to a crossarm vice that has three holes to accommodate varying field conditions.

(*More How To on page* 123)

MARLOWE SUBSTATION—

"Packaged" for Potomac

. . . from penciled line diagram to completed substation—with one contact! That's the story of the building of Marlowe Substation.

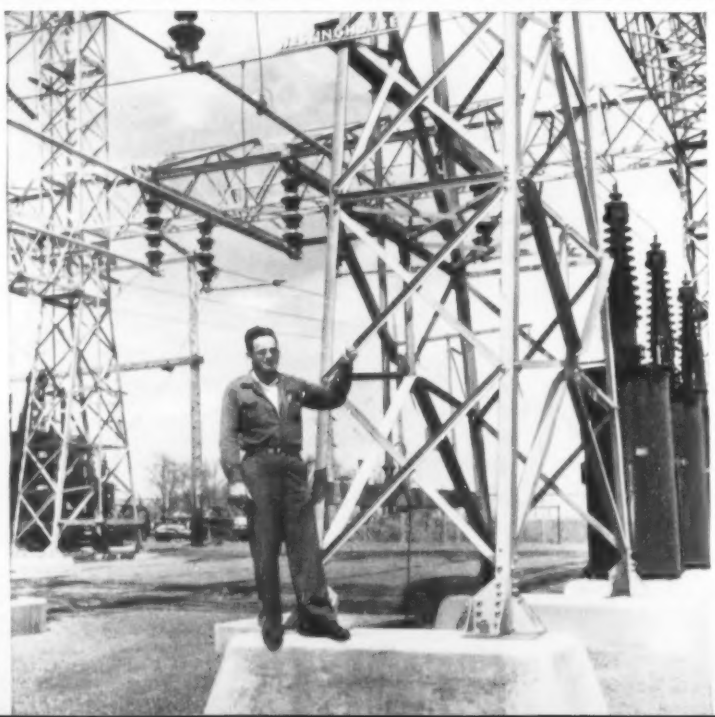
Fast-growing Potomac Edison with headquarters at Hagerstown, Maryland, covers 8,000 square miles of rural, industrial and commercial load area. Their basic transmission triangle, with sides approximately 60 miles in length, has just been stepped up to 132 kv.

Marlowe, master control link in this new system, is a modern coordinated substation. The details of its construction, with some of the outstanding factors responsible for savings realized, are told on the next seven pages.

Grouped in front of the system dispatching board at Marlowe Substation of Potomac Edison Company are (left to right): C. S. James, System Operator; H. H. Startzman, Chief Engineer; W. C. Feaster, Electrical Engineer—all of Potomac Edison—and J. N. "Nick" King, local Westinghouse representative—Potomac's one contact.

Westinghouse

Over-all view of Marlowe Substation—operational headquarters of Potomac Edison's 8,000-square-mile system. A fully coordinated modern substation by Westinghouse.



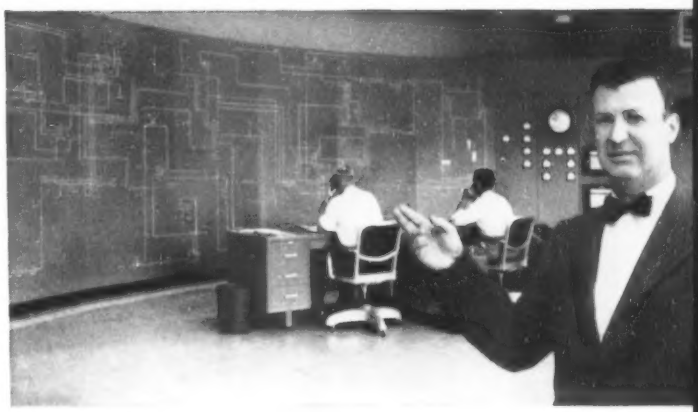
K. C. Miller, Construction Foreman for Potomac Edison, who was in charge of building Marlowe Substation. The complete packaged coordination of Marlowe made his job easier—and faster. Note space-saving underhung Type RL side break disconnects for circuit breaker isolation.

Modern Marlowe Substation is Potomac's operational nerve center

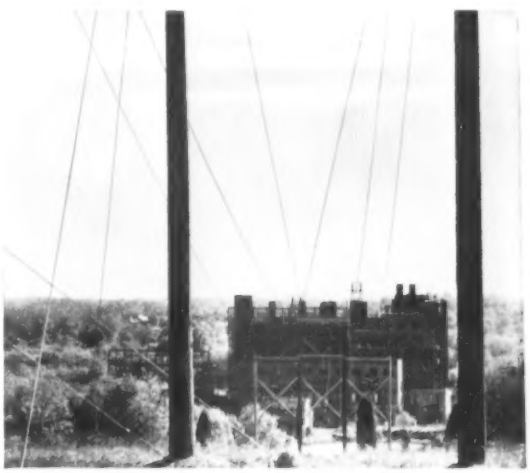
The site for Marlowe Substation—on the high south bank of the Potomac directly opposite the R. Paul Smith generating station—was selected for three reasons. First, it avoids the possibility of flood, which in 1936 completely submerged the first floor of Smith Station. Second, the high south bank enables Marlowe to avoid excessive maintenance costs due to smog and fly ash. And third, Marlowe is the load center of Potomac Edison's growing system.

From Marlowe, system load dispatchers supervise and control transmission of power to all points on company property—utilizing microwave and power line carrier for communication and protective relaying. The most modern of protective and control equipment makes Marlowe Potomac's most efficiently operated substation.

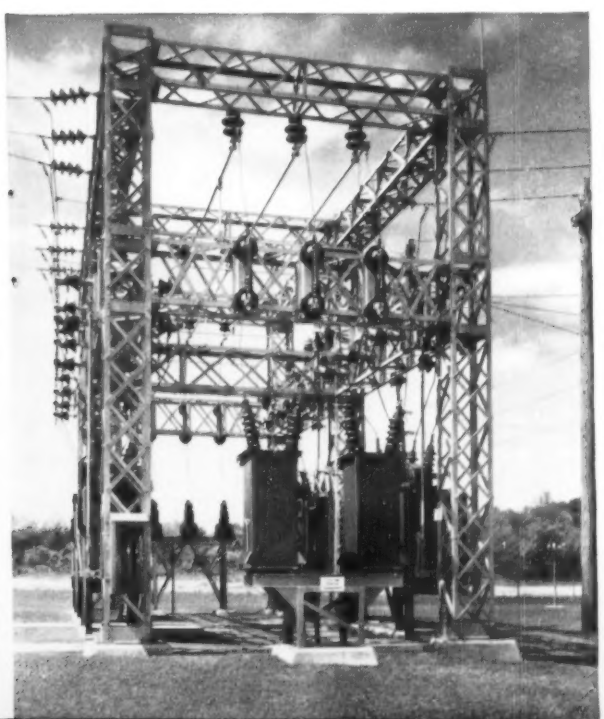
Let's see how Nick King and Westinghouse helped Potomac to beat their construction deadline and also, in the words of H. H. Startzman, Chief Engineer of Potomac Edison, made possible "substantial savings in engineering costs".



C. S. James and his system dispatchers at the large, color-coded dispatching board at Marlowe. From this point, dispatchers supervise and control transmission of power throughout the system.



View from Marlowe Substation down the hill and across the Potomac River to the R. Paul Smith Station—largest of Potomac's 15 generating stations; capacity 91,400 kw.



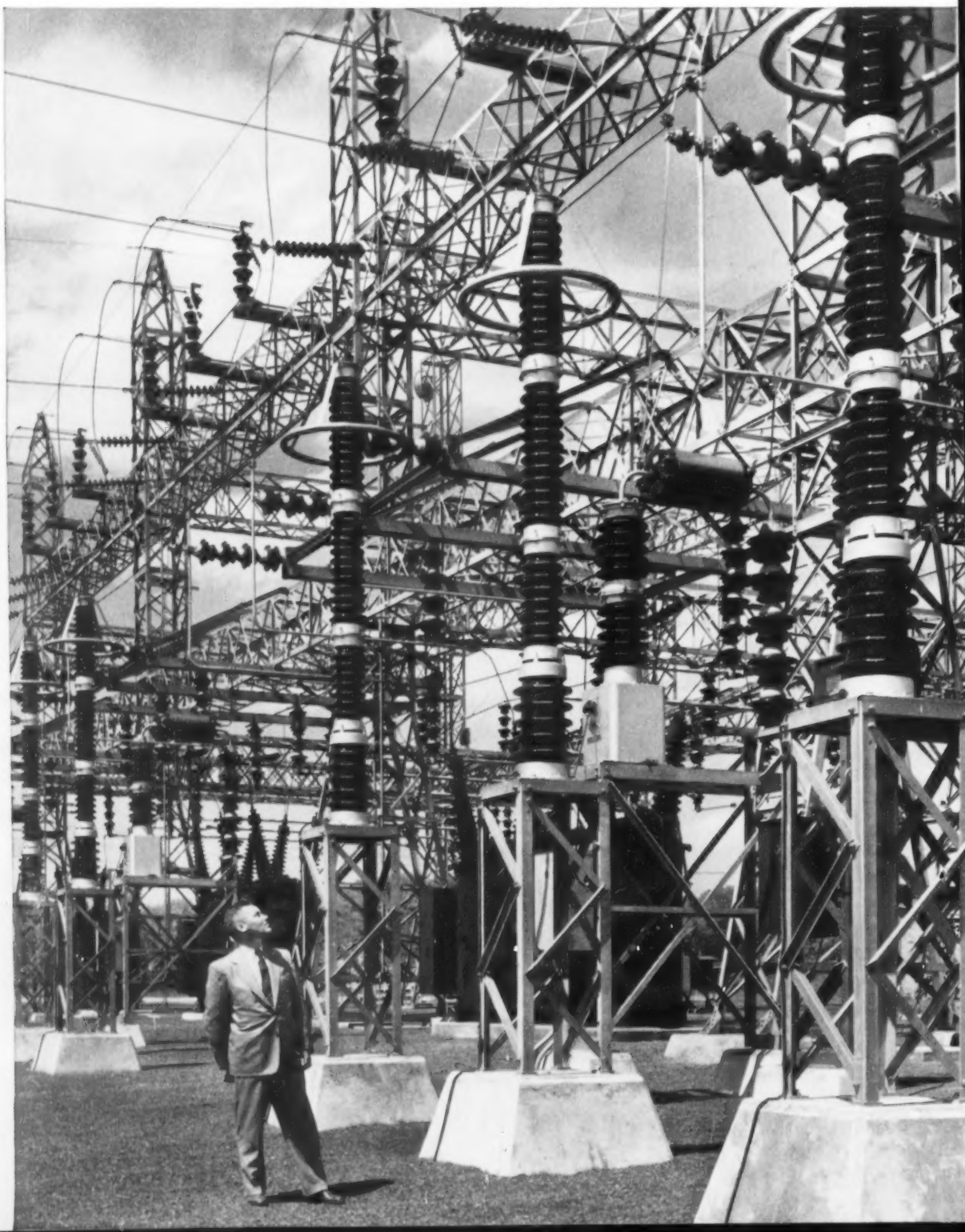
"Package within a package" is this 34.5-kv unit which supplies the area surrounding Marlowe Substation. Shown in the foreground are Westinghouse Type SL station service transformers protected by BA De-ion® power fuses.

YOU CAN BE SURE...IF IT'S

Westinghouse

From penciled diagram to an "on-the-line" substation . . . with

"It went up so easily," said Doc Miller, Construction Foreman of Potomac Edison, "we thought there must be a catch to it. *There wasn't!*" The reasons why Marlowe Substation "went up easily" are good ones. From the time that W. C. Feaster handed Nick King a simple penciled diagram of basic requirements, the coordinated sequence of events occurred like this:



one source . . . Westinghouse

First, complete drawings arrived at Potomac which showed the general layout of Marlowe Substation. Details were included which permitted Doc Miller to begin building foundations. Loading calculations showing thrusts and mechanical stress data showed exactly how much concrete to use.

Equipment drawings then arrived to enable Doc to build pads and arrange for all connections including those underground.

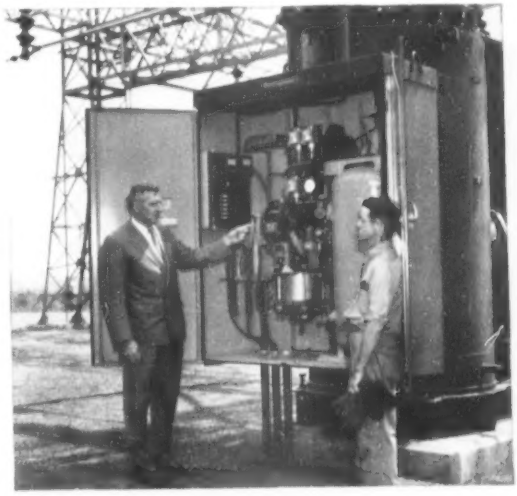
The complete station structure came in on schedule and Doc Miller and his crew erected it using detailed erection drawings which accompanied it.

Power circuit breakers were next on the scene so that they could be placed with the crane which had been used to erect the steel structure.

Final delivery of all remaining equipment including a 40,000-kva "Form-Fit" power transformer, lightning arresters, disconnecting switches, power fuses, instrument transformers, line traps and many other items was made when Doc was ready for them.

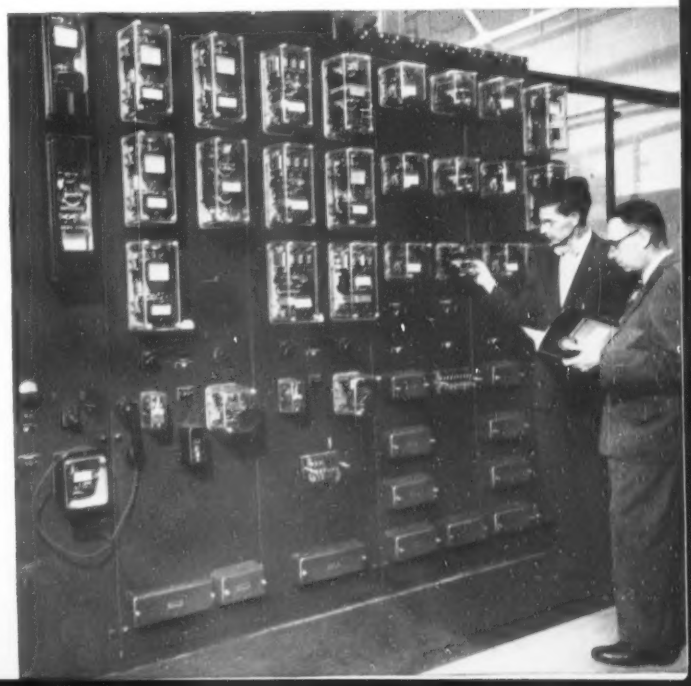
Marlowe Substation including communication and relaying apparatus was energized on July 30, 1953—well ahead of schedule.

H. B. Pitzer, Potomac Edison Communications Engineer, at a Westinghouse Type FB microwave radio assembly operating in the 952 to 960 megacycle band. Three repeater stations are used over 70 miles of mountainous terrain to Ridgeley Station at Cumberland, Maryland. Four voice channels, two telemetering, one VHF radio control and one test channel are in use at Marlowe.



W. C. Feaster describes operation of pneumatic mechanism of a Type GM-4-A, 138-kv class circuit breaker to E. E. "Ed" Hays, Substation Operator at Marlowe. The Type AA-10 pneumatic operating mechanism shown is capable of high-speed, 3-cycle opening and 20-cycle reclosing with minimum shock to parts.

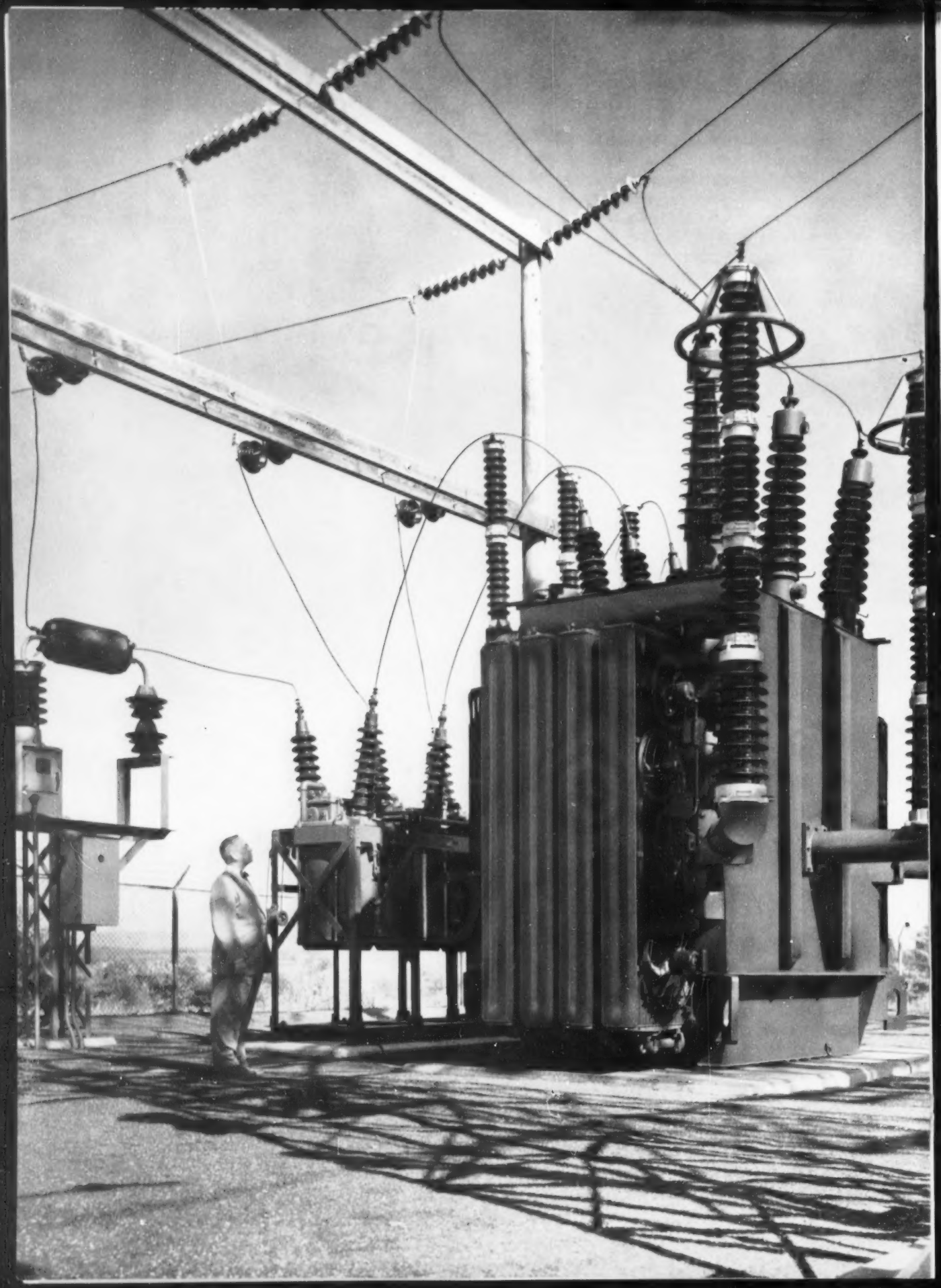
E. R. Cushen, Test Engineer, and Charles Morrison, Planning Engineer of Potomac Edison, at power line carrier relay panel. The first three sections of this panel include Types CR, HKB, HZM and HRP relays for protection of 132-kv lines. The last two panels include Types CA-5, LC-2 and CO relays for transformer and bus protection.



O. L. Wallis, Potomac Edison Assistant Electrical Engineer, inspects Marlowe Substation's Westinghouse station-type Autovalve® arresters which protect the 132-kv equipment. SV arresters will discharge lightning surges of more than 100,000 amperes. They are designed to give the greatest protective margins available in high-capacity arresters.

YOU CAN BE **SURE**... IF IT'S

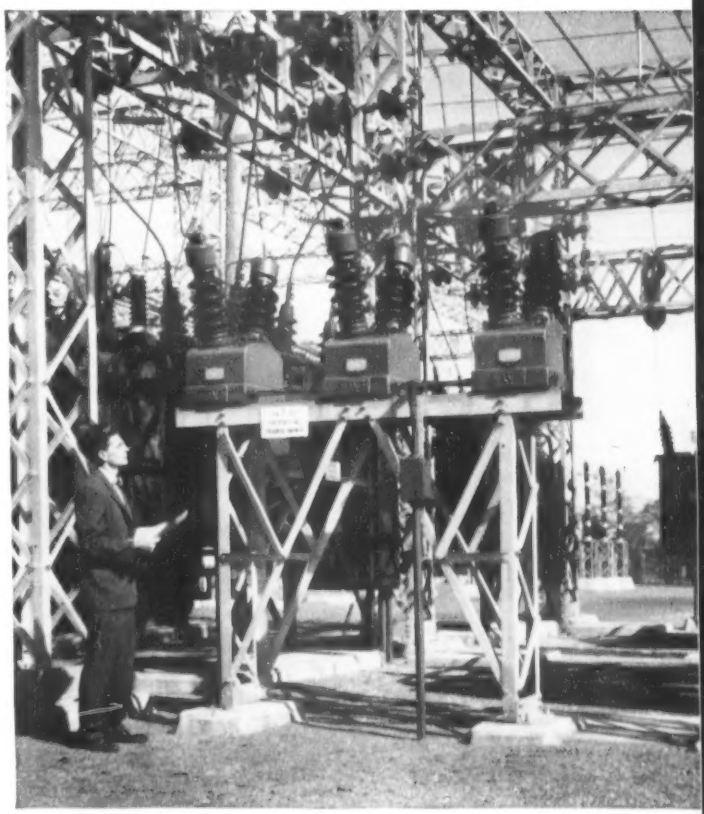
Westinghouse



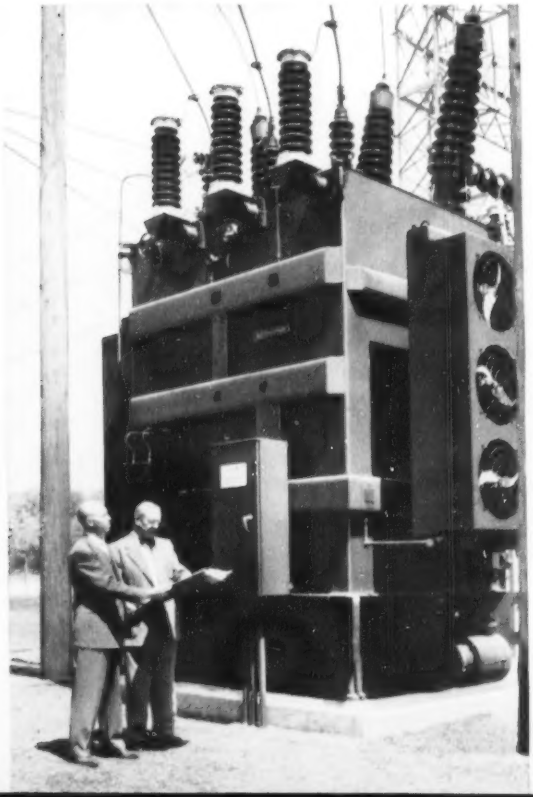
Standardized equipment for Marlowe meant faster delivery... simplified installation... lower costs

Standardized Westinghouse equipment was used throughout Marlowe Substation. It contributed greatly to savings in both time and money because it cut time in engineering, manufacturing, delivery and installation. Doc Miller's construction personnel had no "specials" to deal with.

In addition, the delivery of Marlowe Substation with one order—one supplier—one responsibility—proved conclusively to Potomac Edison executives that substantial savings could be realized while still maintaining rigid standards for reliability and flexibility for future growth. Each component of Marlowe is designed to permit future expansion with minimum changes or additions.



H. H. Startzman at the 69-kv/132-kv, OA/FA Form-Fit power transformer of Marlowe Substation. *Marlowe Substation is the third site for this transformer, since it has been moved with progress of Potomac's 132-kv expansion.* The lighter weight, smaller size and rugged construction of Form-Fit power transformers were distinct advantages to these moves. Note that the SV arresters are mounted on the transformer close to the bushings for maximum protection.

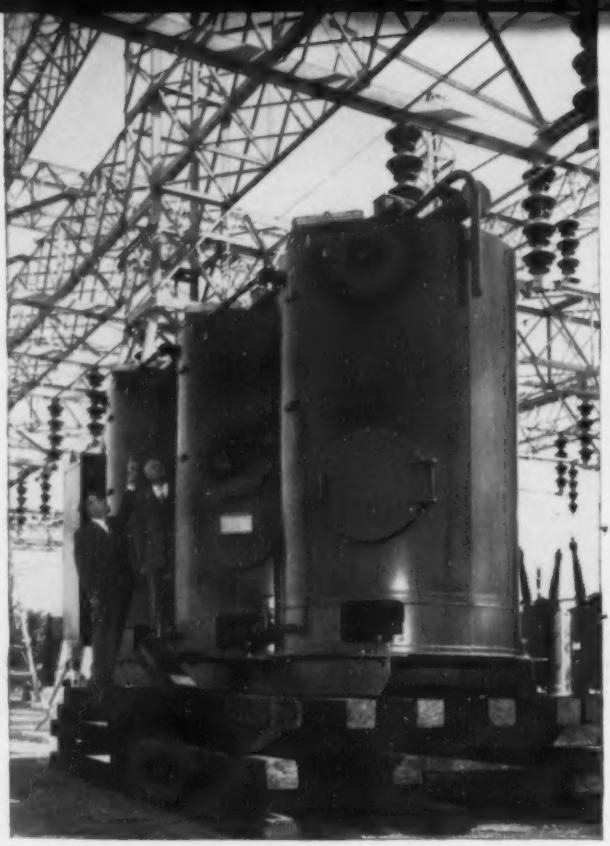


E. R. Cushen checking installation of three Westinghouse OPT, 34.5-kv potential transformers. Westinghouse instrument transformers are noted for reliability and accuracy.

J. N. King and H. H. Startzman, at the 132-kv/34.5-kv Form-Fit power transformer—second largest on Potomac's system. Westinghouse Form-Fit design offers the maximum in mechanical, thermal and dielectric characteristics—at reduced size and weight.

YOU CAN BE SURE... IF IT'S Westinghouse

Marlowe Substation is ready for continued expansion

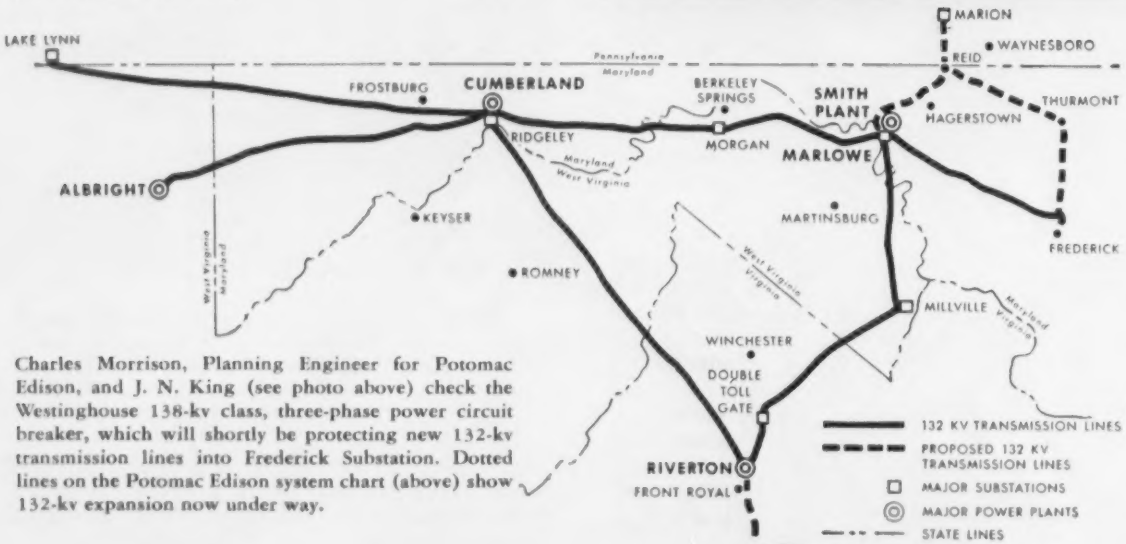


According to H. H. Startzman, Potomac Edison's load in 1933 was 46,350 kw; in 1943, it had jumped to 91,700 kw and 1953 ended with a total of 194,900 kw—more than a 300% increase in twenty years.

With the company actively engaged in all phases of civic and industrial development programs, Potomac Edison is preparing now for at least another 100% load increase by 1963.

Work is under way to extend 132-kv transmission to Marion, Pennsylvania, on the north . . . Thurmont and Frederick, Maryland, on the east, as shown in the system chart below

Marlowe Substation is designed to handle this growth with a minimum of changes and additions—an important factor in Potomac Edison planning. The added advantages of a completely "packaged" substation from one supplier—one responsibility—helped them considerably in meeting their increasing loads economically, without sacrifice of rigid standards of reliability. CP-1023



Charles Morrison, Planning Engineer for Potomac Edison, and J. N. King (see photo above) check the Westinghouse 138-kv class, three-phase power circuit breaker, which will shortly be protecting new 132-kv transmission lines into Frederick Substation. Dotted lines on the Potomac Edison system chart (above) show 132-kv expansion now under way.

YOU CAN BE SURE... IF IT'S **Westinghouse**

Get complete product data on all products shown from booklets listed at right. Available through your local Westinghouse representative, or by writing direct to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

- ☐ Power Circuit Breakers..... B-4012 / B-5834
- ☐ Power Line Carrier..... B-5873
- ☐ Microwave B-5850
- ☐ Power Line Carrier Relays..... LL 41-600.3 / DB 41-412
- ☐ Power Transformers..... B-4142-A
- ☐ Instrument Transformers..... PL 45-000
- ☐ Line Traps..... DB 49-620
- ☐ Disconnecting Switches..... B-4726
- ☐ Power Fuses..... B-5469

Transformer Dolly Prevents Deep Ruts in Sodded Ground

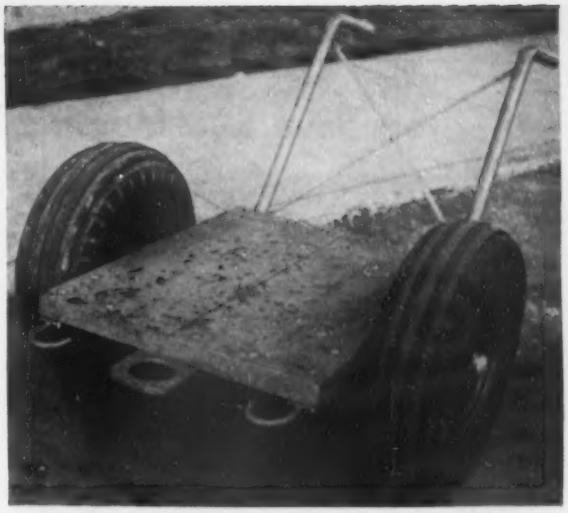
E. A. SHIRLEY, Senior Engineer, Distribution Dept, Indiana & Michigan Electric Co, Muncie, Ind.

A dolly has been developed by the Marion-Muncie Division of Indiana & Michigan Electric Co to transport transformers to distribution circuits located along the rear property lines where no alleys exist. It has large tires and can be rolled over sodded ground without leaving deep ruts and irritating customers.

A 37½-kva transformer can be moved easily by two men. A tall transformer must be chained to the dolly to prevent it from toppling while being hauled over uneven ground. Hooks on the front are for attaching a rope so one man can pull the loaded dolly while another man pushes and guides it.

The dolly is small enough to be carried on a line truck. It is not intended as a trailer and hence does not require a license, but might be towed if a trailer license is attached.

Bed assembly consists of a 30 x 22½-in. frame of 1¾-in. angles and central crosspiece of two 3-in. channels with ⅜-in. steel end plates for attachment of wheel hubs; all joints are welded. Bolted to the frame is a bed of 2 x 12-in. planks. The rest is a 9 x 5-in. U-shaped piece of 2-in. channel bolted to bed and welded to frame at handle end. Front attachments consist of two hooks made of ⅜-in. rod bent to 1½-in. radius and welded to frame and also a 5 x 6½ x ⅜-in. steel plate with 3-in. hole bolted to frame.



HANDLES are 1¼-in. conduit crossbraced with ½x1/16-in. straps, and flattened at lower ends for bolting to dolly frame

Wheels are surplus bomb-dolly tires and rims mounted on salvaged Plymouth hubs bolted to end plates welded to cross channels of of frame.

Water Kegs Iced 3 Times Faster By Automatic Ice Makers

Two automatic ice cube machines in the service building at the Virginia Electric & Power Co, Richmond, Va., save at least 1½ man-hours daily in icing drinking water kegs for line and service trucks. Since ice cubes are not touched during handling, sanitation is greatly improved. Also, ice pick accidents experienced with the formerly used ice chest method have been eliminated.

With the ice cube machines, one attendant can ice 32 kegs between 7 and 8 AM. Previously he was able to ice only 8 or 9 kegs. Each keg is filled with 100 lb of ice cubes. Kegs are placed on a cart after the trucks enter the service building after work.

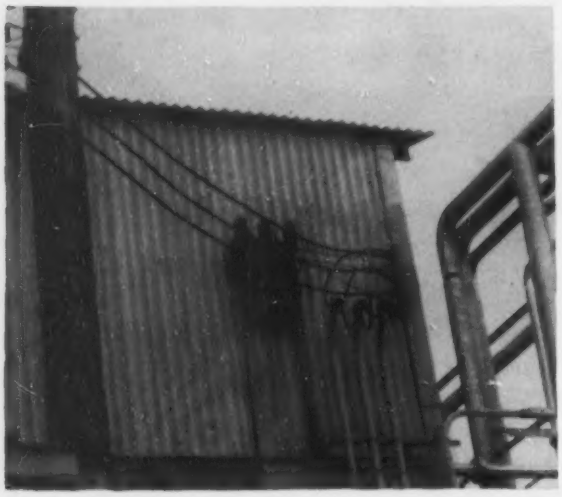
The two ice cube machines are mounted on top a 16-gauge galvanized steel storage container which is lined with 18-gauge stainless steel insulated by 2 in. of cork. Container, which has a capacity of 1,000 lb of ice cubes, was made by a local sheet metal shop at a cost of about $440.

An ice cube agitator having three blades is operated periodically by the attendant, who turns the hand crank on the right side of the container. This agitation keeps the ice cubes from sticking and permits a free flow through the stainless steel spout and nozzle. A hinged step platform under the nozzle permits rapid filling of two sizes of ice kegs—the smaller being for the smaller service trucks.

The two machines have a combined capacity of about 900 lb of ice cubes a day. Each machine cost about $1,200, including installation. Plumbing and electrical connections cost approximately $50. The company estimates that operation of the machines requires 5.9 kwhr for each 100 lb of ice cubes.

WATER KEGS for VEPCO line trucks are filled with ice cubes from automatic ice makers in ⅓rd the time formerly required with ice chest

Capacitors Save $90 Monthly by Correcting Power Factor



C. D. ANDERSON, Power Sales Engineer, Savannah Electric & Power Co, Savannah, Ga.

A 440-v outdoor capacitor installation of 15-kva, costing approximately $150, saves $90 monthly for the Pure Oil Company's Lube Blending Plant, Savannah, Georgia, according to C. L. Limehouse, superintendent. By maintaining the power factor at a minimum of 85% lagging, the customer is eligible for the industrial rate which effected saving over proposed billing on "General Service" rate.

The capacitor is mounted on a rack next to the service entrance with fuse cutouts as disconnect means. The rack mounting was necessary because the motor load was made up of many small motors (7½ hp or smaller). It is left in the circuit at all times, and there are no adverse effects from the voltage rise under no load conditions.

OUTDOOR CAPACITOR installation, mounted on rack adjacent to service entrance, maintains minimum power factor of 85% lagging

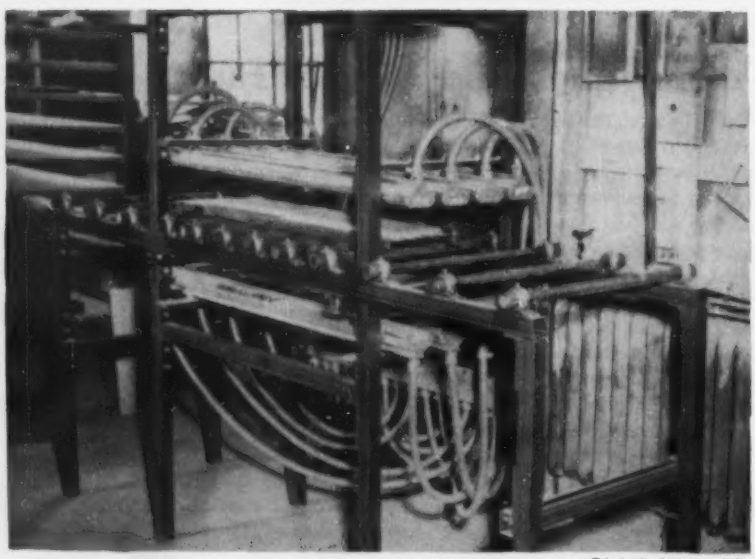
Infrared Furnace Cuts Baking Time of Heaters by 87.5%

The time required to bake electric furnace heating elements has been reduced from 2 hr to 15 min by use of electric radiant heaters. Additional savings and improvement of product are also reported by Cooley Electric Mfg. Corp., Indianapolis, Ind., manufacturer of heating elements for industrial electric furnaces.

Company reports that new installation has produced added advantages of reduced overall power consumption, greater flexibility of production, and requires fewer molds to make a given quantity of elements. Since the molds used are relatively expensive, new element sizes can now be manufactured at less cost and with greater facility.

The manufacturing process consists of molding the elements into rectangular or semi-cylindrical shapes. Before molding, the granular material is moistened as in molding foundry sand. This moisture must be removed by baking at approximately 300 F before firing at higher temperatures.

Convection heating was previously used to dry the elements, but heating time could not be reduced without damaging the units. Forced heating, caused surface hardening which inhibited release of steam from inside the block, resulting in disruption of the structure.



Edwin L. Wiegand Co

ELECTRIC FURNACE ELEMENTS are baked with infrared heaters in one-eighth time required by formerly-used convection heating method. Power consumption is less.

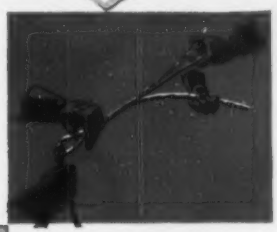
An experimental installation of electric radiant heaters was tried, and it was found that only one-eighth of the best previous time was then required to dry elements as thick as ¾ in. In addition, it was discovered that the penetrating heat produced by this method resulted in desirable, rather than damaging, structural changes in the elements, greatly increasing their strength and thermal conductivity.

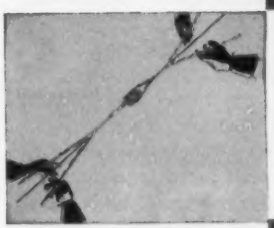
As a result of the experimental work, a permanent infrared oven was constructed using eight radiant heaters rated at 1.8 kw each. These units were easily mounted on a simple structural steel frame so that elements being baked are held on rollers while radiant heat is focused above and below.

GUY-GRIPS COST LESS

per pound of tensile strength

per year of service life





PREFORMED "GUY-GRIPS" are the fastest, most economical and most efficient means of dead-ending guys. They eliminate the need for clamps and ARE INSTALLED BY HAND. Since they cannot slip whether they are dead-ending a 2,000-pound, solid-wire guy or a 40,000-pound, ⅝" EHS steel guy, no retightening is ever necessary.

One large Utility has found that Preformed "Guy-Grips" save 50% on labor and 20% on material. Another assembles and installs a complete Preformed Guy Assembly (4 dead-ends) in the same time it used to take to assemble just one 3-bolt clamp.

PREFORMED "GUY-GRIPS" are proving definitely throughout the Country that they assure:

Maximum { Corrosion Life; Installed Tensile Strength; Fatigue Characteristics; Impact Strength; Neatness in Appearance }

Available in aluminum, copper, bronze (various grades including calsun), copperweld, stainless steel and galvanized steel, PREFORMED "GUY-GRIPS" assure the longest satisfactory guy life.

For complete details of their exclusive advantages, write, or telephone Cleveland: EXpress 1-3571.

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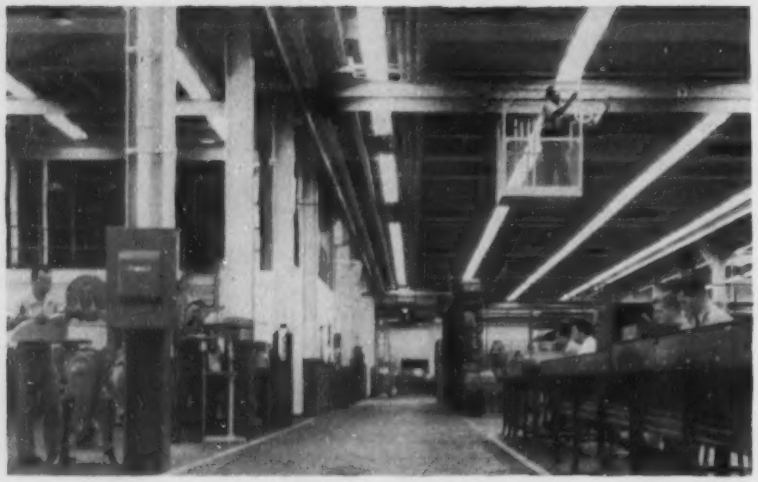


Crane Basket Speeds Lighting Maintenance

Hanging basket on each traveling crane in assembly areas of Peconic River Plant near Calverton, Long Island, N. Y. of Grumman Aircraft Engineering Corp speeds lighting maintenance. Basket accommodates a man and all required maintenance equipment for lamps and luminaries. Fluorescent units provide maintained intensity of 35 ft-c in hangar assembly area. Broadway Maintenance Corp handled entire electrical installation.

Automatic Machine Cuts Buffing Costs

An automatic rotary buffing machine, driven by a 100-hp complement of electric motors has just been put in operation in the plant of the F. H. Lawson Company, manufacturers of sheet metal products in Cincinnati, Ohio. Production has been greatly increased and the number of manhours required for each piece has been reduced. The quality of buffing has been improved to the extent that every finished lid is now better than the best buffing possible by hand. Perhaps the greatest benefit is uniformity. The buffing of every lid is practically perfect. As a result of the uniform and excellent buffing, rejects are practically unknown and buffing costs have been drastically reduced.

Six 15-hp, 240-v, 3-phase, totally enclosed, fan cooled, squirrel cage induction motors are used to drive the buffing wheels. The machine is self-indexing and automatically positions the work before the buffing wheels. A variable speed motor drive operates the rotary table which carries the work from one buffing wheel to the next. Cannister lids are held in place on work holding fixtures on the rotary table by means of a vacuum.

Motors rated ¼ hp drive the feed motion for the buffing wheels. The buffing pressure is automatically controlled by the current drawn by the main buffing wheel motors. If this current exceeds a predetermined value, the feed motion motors automatically withdraw the buffing wheels from the work until a position is reached where the current is reduced to normal. Electromagnets, electronically controlled, automatically feed the proper amounts of buffing compound on the buffing wheels.

The entire buffing operation is automatic. A cannister lid is placed on a holding fixture on the rotary table and a vacuum holds the lid in place for buffing. The rotary table moves the lid to the first buffing wheel where it stops and is buffed for a predetermined length of time. Then the rotary table successively moves the lid to each of the five remaining buffing wheels where it is buffed for a preset time interval.

After the cannister lid leaves the last buffing wheel, the vacuum is cut off and the lid released, a perfectly finished, highly buffed product. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

INDUSTRIAL BRIEFS

Cleaning metal parts in soda wash and rinse (prior to spray painting) heated with 84 kw in immersion heaters at Columbia Industries, Inc, Lancaster, Pa., realized savings by eliminating fuel and operator costs (during summer months) of the company's heating plant. Formerly, the wash and rinse were heated by steam supplied by the company's heating plant located 300 ft from the cleaning operation. The plant was required to operate during summer months and the operation consumed more than 10 tons of coal per week. Clyde Oberholzer, Industrial Power Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

Baking paint samples in infrared oven in research laboratory of Harrison Paint & Varnish Co, Canton, Ohio permits complete duplication of customer's infrared oven heating cycle, considerably reduces labor and increases efficiency. Previously used convection oven failed to match customer's results obtained in infrared ovens. The new oven has 6-800-w heaters with internal control timer and thermocouple attached to work piece which makes possible the duplication of customer's heating cycle. Oven ventilation is controlled by variable openings in bottom, top, front and back. G. W. Craiglow, Industrial Power Engineer, Ohio Power Co, Canton, Ohio.

Electric heating cable installed under the walks and driveway around the home-office of Dr C. E. Conklin, Salt Lake City, keeps them snow-free. Cable used for the job is rated 5 kw, 220 v. Richard Pizza, Consultant, Business Development Dept, Utah Power & Light Co, Salt Lake City.

Producing steam with a 150-kw electric steam generator for livestock feed pellets at Dand E. Feed Mill, Ney, Ohio, eliminates fire hazard of flame-type boiler and permits location in same building with production operations without increasing insurance costs. The steam is shot into the feed mix to make it stick and form pellets. Martin L. Bettinger, Power Sales Engineer, The Toledo Edison Co, Toledo, Ohio.

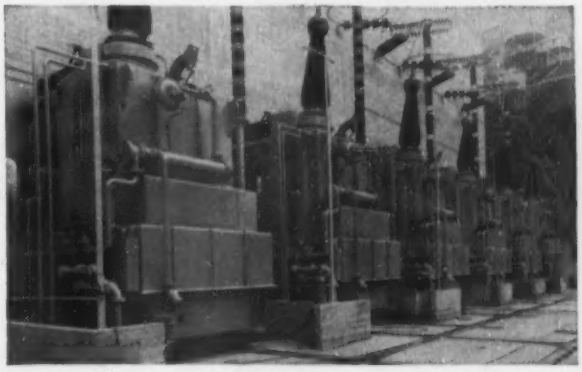
WHERE is this 230 kv Pennsylvania Transformer going?

The snow and tall fir trees in the background of the top photograph are two substantial clues that this transformer is headed for the Great Northwest. Further study of the picture will reveal that the transformer is *traveling in an upright position* and is *completely assembled* except for bushings and forced-cooling equipment.

When a large power transformer arrives at its installation site in this manner, ordinary rigging methods can be used to move the transformer from the drop center railway car to the foundation pad. Time and money will be saved in this operation — especially in remote places where special or heavy rigging equipment is not readily available.

Furthermore, the problem of putting a transformer into service is greatly simplified when it arrives at its destination completely assembled and in a one-piece tank. That was how the six transformers in these two 87,000 Kva banks reached the Great Northwest.

Prior to shipment, the covers were welded shut and the units gas-filled to keep the interiors of the transformers dry for their trip across the country. When the bushings, heat exchangers, and accessories were assembled, the transformers were ready for operation.



Contour-design, shell-form power transformers, such as these 230 Kv, 29,000 Kva units, can be designed and built by Pennsylvania in sizes up to 300,000 Kva and in voltages up to 330 Kv.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division • **CANONSBURG, PENNSYLVANIA** • *Greater Pittsburgh District*

Two-for-one campaign keeps 'em busy as Public Service of New Hampshire . . .

Sells Blankets by the Carload

M. T. CARTER, General Commercial Manager, Public Service Co of New Hampshire, Manchester, N. H.

What can be done to bolster lagging electric blanket sales?

Wrestling with this problem at Public Service Company of New Hampshire last fall we came up with a "two-for-one" campaign that delivered 3000 blanket sales in just 90 days. And we could have sold more if we hadn't run out.

Prior to this campaign, we had conducted a blanket activity in the fall of each year, with what we considered not too good results. In 1952 we took a nose-dive. Our activity that year produced just under 200 sales. We knew we had to find some sort of a "shot-in-the-arm" or give it up.

To accomplish what we had in mind, we realized we would need, besides our nationally advertised brands a "leader" blanket of outstanding value on which a volume promotion could be built. We settled on a lesser known, but reliable brand for this purpose on which we had first-hand reports of its service record and sales acceptance from a neighboring utility.

We made every effort to keep the campaign as simple as possible. Our records showed that double control blankets were a very small percentage of our total sales in the past years; and as far as the twin size was concerned, we had always made an effort to sell away from it—to the full-bed size blanket. Therefore, we decided on a single model for our leader blanket.

Color presented a real problem. With 24 sales outlets we knew (because of advanced ordering which is necessary with direct factory purchasing) we'd be in a mess if we guessed wrong in our color breakdown. A tremendous amount of transshipping would be needed between our stores in order to have the right color at the right place at the right time. After kicking this problem around we decided to use just one color, "Dusty Rose," the most neutral of those available. Looking back on the campaign, we now believe that that was the smartest decision we made. With this blanket we were offering a bargain which, to get, the public was willing to compromise their ideas on colors and model. If we had offered the full range of colors, we would have been simply adding a low-priced blanket line.

In setting up the campaign we reasoned that if we had a sufficiently good value, with the proper terms, and the salesman's incentive properly pitched, we could sell more than one blanket to a customer. We felt that if we could convince the customer that he should have an electric blanket in the first place, then there was certainly a need for one or more additional blankets in that home. This thinking developed the slogan and the "gimmick" of our campaign: "Two For The Usual Price Of One."

We took the full margin mark-up on the first blanket, pricing it at $29.95. But we promotionally priced the pair at $44.95. The down-payment on the single blanket was $2.95; it was $2.95 if they bought the pair. The monthly payment on the single blanket was $5.00; it was also $5.00 if they bought the pair. Thus it was just as easy to buy a pair as a single, and of course they were getting the second blanket for only $15.00.

We paid a sales bonus of $2.00 on

Mr. Carter delivered this paper at a recent Edison Electric Institute Dealer Workshop in Berlin, Conn.

Here is the most complete fire protection program ever offered

TRAINING FOR YOUR PERSONNEL at your plant is provided by Ansul fire control experts without cost to you.

VISUAL AIDS for your safety meetings designed to make all your employees fire-control conscious.

CUSTOMER SCHOOL AT MARINETTE—best equipped fire control school available for training your key safety personnel.

COMPLETE PLANT SURVEY provided by Ansul is designed to give you the best fire protection possible at the lowest cost.

Ansul Fire Equipment is Faster, More Effective

A positive activating system puts Ansul's "Plus-Fifty" dry chemical to work immediately. To insure full fire coverage, patented nozzles deliver the right kind of stream for your fire protection problem (low velocity or long range). Ansul extinguishers are water-tight, corrosion resistant, always ready for action, even after extreme weathering. Quality features like these make it possible for Ansul to back their equipment with a 5-year warranty.

Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Division, Department F-154, Marinette, Wisconsin.

ANSUL

a single blanket and $5.00 on a pair. Selling blankets in pairs appealed to both the public and our sales people. Out of 3,000 blankets sold, single sales amounted to only 18.

Quota at the campaign's outset was 1,000 blankets. With one newspaper ad and five days of selling, we could see a trend which we thought justified our placing an order for an additional 2,000. By the third week of the campaign we were running one of those "sorry, we're out—more on the way" ads.

When our second order arrived, we took a picture of the car being unloaded and promoted it to the limit. Two days before Christmas we were completely sold out. Timidity in not placing a third order in December cost us several hundred blanket sales.

Maybe we shouldn't say these sales were lost, because we have had inquiries at our stores all over the state, as to whether or not we were going to have another blanket sale this year. We are in this second campaign now. And with an initial stock of 2000 to carry us through, we are carrying out this year's activity with the enthusiasm with which we ended last year's; plus the knowledge that we have 3,000 additional satisfied customers, plus a product service record which is the best we have ever experienced, plus an even greater bargain price-wise.

Montana Pushes Three Simultaneous Campaigns

Three simultaneous sales campaigns are Montana Power Co's way of winding up its commemoration of Light's Diamond Jubilee.

The promotions include a "Buy Six —Get Seven" bulb campaign, a portable lamp campaign and a repeat of its successful 1953 rural campaign on appliances and electric water systems.

Bulb campaign offers a free 200-w lamp with the purchase of six or more bulbs at one time. Cooperating in the program are manufacturers, distributors and retailers of electric bulbs. Program, which ends Tuesday aims to fill empty sockets in 112,000 homes; stimulate dealer bulb sales, particularly those of higher wattages, and focus public attention on Light's Diamond Jubilee.

Company has sent residential customers a coupon redeemable for a 200-w bulb. Distributors give dealers a bulb for each coupon received and the company reimburses the distributors. Company home service advisors also present free 200-w lamp bulbs to those at group lighting presentations.

"Beauty Plus" Lamps . . . in its portable lamp campaign, the company will push "Beauty Plus" lamps to tap the potential market for 250,000 lamps it believes exists in its service area.

The company is serving as a mail-order house during the campaign. A brochure describing lamps available and their prices and terms are being sent to customers. A six-for-seven bulb coupon also is included in each brochure. Lamps are made available directly through Montana Power or any participating dealer. Purchasers may pay cash, charge, or pay on monthly terms.

Discounts on retail prices are offered to dealers—25% when lamps are picked up by the dealer for delivery to customers and 20% when the company delivers directly. Montana Power employees also get discounts and terms. Utility hopes to sell at least 6,000 lamps itself before the activity ends sometime in 1955.

Rural Repeat . . . the rural sales campaign is a repeat performance of the initial program held last year (EW, July 13, 1953, p 180). It offers coupons worth from $10 to $25 which customers may use toward purchase of any of five major appliances they do not now own. The dealer making the sale is reimbursed by the company.

Last year's rural sales efforts resulted in the purchase of 2,383 appliances and water systems. Quotas of 1500 ranges, 1500 water heaters, 500 freezers, 500 dryers and 300 water systems have been set in the current campaign. Heater, range and dryer quotas are more than double the number sold last year. Promotional support is provided through advertising in 50 weekly papers, home service demonstrations and dealer, distributor meetings.

J. E. Corette Business Development Awards will be presented to company personnel registering the highest sales during the three campaigns.

Refrigerator Can Be Mounted on Wall

This built-in wall cabinet refrigerator-freezer and room air conditioners with higher power factor are among major home appliances introduced by General Electric Co in their 1955 line. Power factor will go to 85% for most air conditioner models and reach 90% for the ½-hp unit. Other new appliance items: quick recovery water heater of small capacity (40 gal) heated by two sets of 4.5-kw coils; a single kitchen service unit with built-in appliance components including combination washer-dryer, waste disposer-equipped sink, automatic dishwasher and electric range.

DOW

PENTA

clean wood preservative makes poles better neighbors ... and protects them against termites or decay

THE DOW CHEMICAL COMPANY,
Dept. PE-746B-1, Midland, Michigan

☐ Send me free information on PENTA-treated poles and crossarms.

☐ Send me a list of PENTA-treating plants.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

This pole, "home base" for neighborhood "hide and seek", was treated with *clean* PENTA*. Poles with a clean PENTA treatment installed in city areas meet the most strict civic requirements, and win the community's good will.

An equally important, and even more tangible benefit: PENTA-treated poles and crossarms have *measurable, effective protection* against decay and termites. Users save thousands annually in avoiding premature replacement costs. And linemen know there's a *lot* of difference in working on a pole that's had the benefit of *clean* PENTA treatment.

Over 60 suppliers across the country can provide PENTA-treated poles of carefully controlled uniform quality . . . be sure *you* win friends while saving costs: Ask your regular supplier about clean *PENTAchlorophenol, or write THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS DOW

Shipments, Orders and Open Manufacturing Capacity for Electrical Equipment, 1953-1958

Total Capacity Shipped and on Order and Scheduled for Shipment	Shipped 1953	On Order as of Oct. 1, 1954 — 1954[8]	1955	1956	1957	1958	Total Scheduled for Shipment as of 10-1-54	New Capacity Scheduled 4-1-54 to 10-1-54	Capacity Shipped 4-1-54 to 10-1-54
LARGE STEAM TURBINE-GENERATORS[1] (10,000 Kw and Larger)[1]									
U. S. Electric Power Systems	9,930,500	10,779,200	9,620,200	4,396,900	1,313,700	308,000	19,029,100	3,082,300	5,221,900
U. S. Industrials	769,100	428,000	90,600	162,500	.....	.....	281,200	233,100	222,800
Outside U. S.	227,100	453,000	522,600	250,000	.....	.....	945,200	412,500	142,900
TOTAL	**10,926,700**	**11,660,200**	**10,233,400**	**4,809,400**	**1,313,700**	**308,000**	**20,255,500**	**3,727,900**	**5,587,600**
Estimated Open Capacity[7]	.....	.....	75,000	7,700,000	12,700,000	13,700,000			
SMALL STEAM TURBINE-GENERATORS[2] (4,000 to 9,999 Kw)[1]									
U. S. Electric Power Systems	93,800	74,900	65,600	.....	9,400	.....	96,800	56,200	34,400
U. S. Industrials	200,600	171,600	69,400	.....	.....	.....	106,300	71,900	89,700
Outside U. S.	146,900	108,100	38,100	.....	.....	.....	71,800	33,700	41,900
TOTAL	**441,300**	**354,600**	**173,100**	.....	**9,400**	.....	**274,900**	**161,800**	**166,000**
Estimated Open Capacity[7]	.....	.....	600,000	1,400,000	1,400,000	1,400,000			
STEAM GENERATORS (450 Psi Pressure and Higher)[2]									
U. S. Electric Power Systems	83,304	79,638	46,555	9,648	2,250	.....	76,306	29,670	37,350
U. S. Industrials	22,072	14,464	3,137	.....	.....	.....	5,509	3,922	6,925
Outside U. S.	9,561	7,972	4,430	425	.....	.....	8,377	4,341	2,965
TOTAL	**114,937**	**102,074**	**54,122**	**10,073**	**2,250**	.....	**90,192**	**37,933**	**47,240**
Estimated Open Capacity[7]	.....	.....	29,000	134,000	142,000	145,000			
WATER-WHEEL GENERATORS[3] (4,000 Kw and Larger)[1]									
U. S. Electric Power Systems	1,421,600	1,420,100	1,223,300	414,500	35,000	.....	1,905,700	164,000	636,200
U. S. Industrials	13,100	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	231,400	199,000	178,600	16,200	.....	.....	241,500	.....	72,200
TOTAL	**1,666,100**	**1,619,100**	**1,401,900**	**430,700**	**35,000**	.....	**2,147,200**	**164,000**	**708,400**
Estimated Open Capacity[7]	.....	.....	200,000	2,300,000	2,700,000	2,800,000			
HYDRAULIC TURBINES (5,000 Hp and Larger)[3]									
U. S. Electric Power Systems	1,746,100	3,205,400	2,258,800	813,400	765,200	180,000	5,064,900	140,000	1,441,000
U. S. Industrials	16,800	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	292,100	67,000	119,600	.....	.....	.....	119,600	90,300	25,000
TOTAL	**2,055,000**	**3,272,400**	**2,378,400**	**813,400**	**765,200**	**180,000**	**5,184,500**	**230,300**	**1,466,000**
Estimated Open Capacity[7]	.....	.....	1,100,000	3,200,000	3,700,000	4,300,000			
POWER TRANSFORMERS (501 Kva and Larger)[4]									
U. S. Electric Power Systems & Industrials	55,597,000	62,136,000	22,328,000	4,520,000	25,000	.....	45,001,000	6,880,000	26,078,000
Outside U. S.	1,709,000	1,533,000	2,075,000	64,000	.....	.....	2,675,000	1,012,000	673,000
TOTAL	**57,306,000**	**63,669,000**	**24,403,000**	**4,584,000**	**25,000**	.....	**47,676,000**	**7,892,000**	**26,751,000**
Estimated Open Capacity[7]	.....	1,000,000	49,000,000	70,000,000	73,000,000	73,000,000			

[1] Figures in kilowatts. [2] Figures in 1,000 lb steam per hr. [3] Figures in horsepower. [4] Figures in kilovolt-amperes. [5] Basis of manufacturers' maximum capability of units. [6] Manufacturers' rating of the generators. [7] Estimated open manufacturing capacity for production of additional units. [8] Data for 1954 includes 9 months shipments plus 3 months scheduled shipments.

Power Units Hit Record

Additions to steam and hydro plants will total 12,065 Mw for 1954. Another record may be 1955 with 12,990 Mw

Scheduled additions to steam-electric and hydro-electric generating capacity (4,000 kw and higher) on U. S. power systems in 1954 is expected to total 12,065,000 kw, the highest on record. If shipments are on schedule in 1955, installations will total 12,990,000 kw, the added generation will be higher than in 1954 and thus another new high record will be made.

These highest added generation values are adapted from the 16th semi-annual electric power survey prepared by Edison Electric Institute. The survey is based on information supplied by 19 of the country's leading manufacturers of heavy electric power equipment for utilities, as of October 1, 1954.

The EEI survey covers steam turbine-generators, steam generators, hydro-electric generators, hydraulic turbines and transformers. Accompanying data are presented on production schedules, shipments, and open manufacturing capacities for 1953 through 1958. Data pertaining to steam turbine-generators are based upon the manufacturers' maximum rated capability, the other equipments on nameplate ratings.

Production . . . Electric generating equipment, thermal and hydraulic, scheduled for U. S. electric utilities in 1954 totals almost 12,275,000 kw. This amount is 828,300 kw higher than the shipments in 1953. The increase is entirely in thermal generating equipment. Scheduled production of hydro-electric generators in 1954 totals 1,420,000 kw.

Scheduled production of thermal and hydraulic generating capacity for U. S. utilities in 1955 (based on Oct. 1, 1954 data) totals about 10,909,000 kw, in 1956 about 4,811,500 kw, in 1957 about 1,358,000 kw, and in 1958 about 308,000 kw.

Shipments . . . Deviation or change in shipments is relatively small and presumably is due to manufacturing reasons. In the case of hydraulic turbines, shipment is up to or ahead of schedule.

Slippage in steam turbine-generator shipments is almost 1,304,000 kw. This amount is about a month's pro-

Here's what we mean by SIMPLE!

To change the ratings on this regulator, just move two limit switch pins

DO A WEEK'S job in minutes! With the *Vari-Amp* feature on Allis-Chalmers single-phase power regulators only three simple steps are needed to change ratings.

All you do is (1) open the position indicator window, (2) place the "raise" and "lower" limit switch pins in desired positions, and (3) close the window. That's all there is to it! No need to take regulator out of service. No electrical connection to make. No complicated adjustments or wiring. All other single-phase power regulators require 10 complicated, time-consuming operations to change windings.

Get Five Ratings in a Single Unit

With Allis-Chalmers single-phase power regulator you get five ranges of operation instead of the usual two. In most cases, initial cost is lower because of this flexibility. And, you can increase capacity with only a proportionate decrease in range of regulation. The *Vari-Amp* feature also provides extra short-circuit capacity.

Get complete facts on the convenience, flexibility, and reliability of Allis-Chalmers single-phase power regulators. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Milwaukee 1, Wis., for Bulletin 01B6065C.

A-4462

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

A-C ALLIS-CHALMERS

duction. It is not uncommon, according to an industry spokesman; in fact it is less than the previous year. Shipment slippage for steam generators and water-wheel generators is comparatively small.

New Orders . . . Orders for new equipment were slow in issuance in early 1954. Two manufacturers have offered plans to induce orders being placed in anticipation of requirements, to avoid production back log and to retain technical and production organization.

Since July orders have gradually increased. Considering the steam turbine-generators for new capacity scheduled from April 1 to July 1, 1954—for 1955, seven units totalled 169,875 kw; for 1956, five units totalled 441,000 kw; for 1957, no units. New capacity scheduled has increased and the additions from July 1 to October 1 are—for 1955, thirteen units totalled 668,000 kw; for 1956, ten units totaled 1,375,250 kw; for 1957, four units totalled 484,375 kw.

Hydro-electric generator additions for July 1 to October 1 are—for 1955, no units; for 1956, two units totalled 128,000 kw; for 1957, no units.

U. S. Equipment . . . The foregoing figures are based on the EEI survey and relate to equipment for U. S. electric utilities only. And this represents the bulk of the business of the equipment manufacturers in the United States.

New ASA Standards On LV Air Breakers

Increased use of electricity by commercial and industrial establishments means much higher short-circuit currents when trouble occurs. Where old power systems have been extended by adding transformer capacity, and utilities have added generating capacity and heavier lines, originally installed protective devices are frequently inadequate to safely interrupt the higher short-circuit currents. Engineers are aware that devices with much higher short-circuit interrupting ability should be installed, but may not be familiar with methods of determining the short-circuit potentialities of their systems, or with the capabilities of the available protective devices.

According to V. L. Cox, chairman of ASA Committee C37 on Power Switchgear (General Electric Co, Philadelphia), the engineer must have standards by which to judge the validity of his calculations of short-circuit currents, and the adequacy of the devices he selects to cope with them. Usually the most important device he will need is the large air circuit breaker, which is the subject of three recently issued American Standards:

- Low Voltage Air Circuit Breakers (Including Application Guide), C37.13-1954
- Test Code for Low Voltage Air Circuit Breakers, C37.14-1954
- Rated Control Voltages and their Ranges for Low Voltage Air Circuit Breakers, C37.15-1954

A fourth standard, Preferred Standard Ratings of Low Voltage Air Circuit Breakers, is in preparation by the ASA Subcommittee on Low Voltage Air Circuit Breakers.

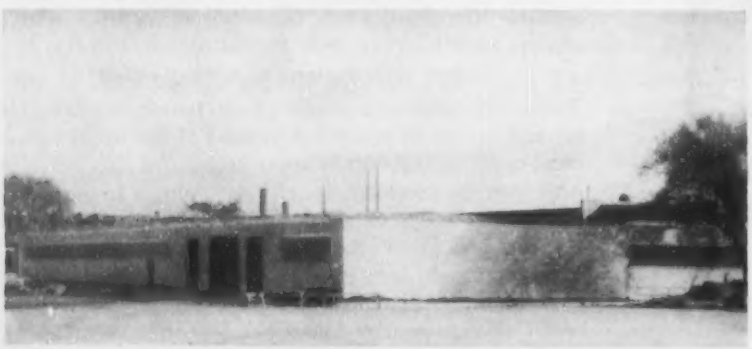
This group of standards should aid the engineer charged with design of low-voltage power distribution facilities of an industrial plant, utility installation, or large commercial building. The Application Guide in C37.13 will acquaint him with a simplified method, accepted throughout the industry, to quickly determine from known data and with normally sufficient accuracy the short-circuit currents his system can develop.

The standards will acquaint the engineer with the terminology of the circuit breaker art, and indicate the conditions he must consider in selecting breakers. The standards also indicate the tests the manufacturer should use on the breakers.

When issued, the preferred standard ratings will guide the engineer in selecting breakers to meet his needs, and which manufacturers will be prepared to supply in a minimum of time and at lowest cost.

To manufacturers, the new standards point the way to realistic planning of designs and manufacturing facilities to meet the demand for breakers required by widespread distribution system improvements. The present $10 million annual production of large air circuit breakers will be greatly increased if industrial power users are awakened to the advantages in increased safety and continuity of production which can result from improvement in their power systems.

These standards are the result of close cooperation between makers and users of the product. Credit is due to the ASA Subcommittee and many individuals who aided in the preparation.



S&C Electric Co Expands Plant

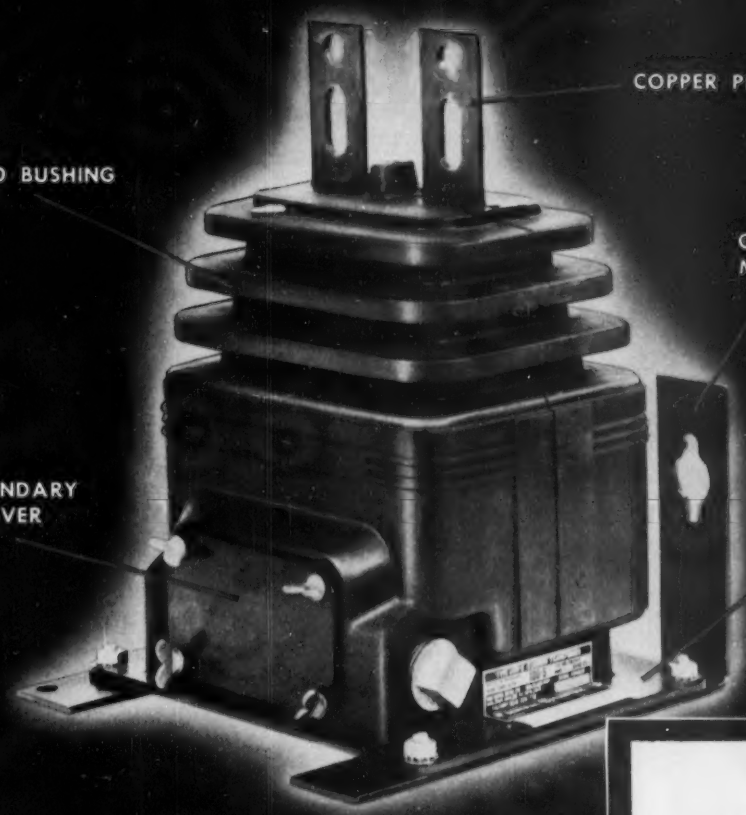
S&C Electric Co has completed a $200,000 expansion program of the Ridge Avenue plant, Chicago. Floor space for assembly and shipping has been increased by 21,000 ft, an increase of one-third. All domestic manufacturing operations will be carried on at this one location.

The Ravenswood Ave building will house only general office and engineering functions. Machine shop activities will be transferred to Ridge Ave.

Copper Production Up

Domestic production of primary copper, according to the Copper Institute, for October was 68,521 tons. This is a slight increase from 61,827 tons in September, and almost a 30% increase over the year's low output of 52,825 tons in August.

Refined copper production was 92,258 tons in October and is a slight increase over the year's low of 87,874



G.E. designs light, compact, 5 KV current transformer with high resistance to corrosion

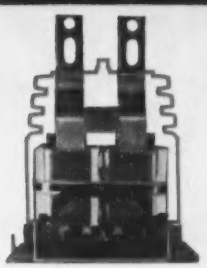
One third smaller and lighter, the new butyl-molded, outdoor, Type JKW-3 transformer is easier to install and maintain.

Almost completely corrosion-proof, this new General Electric current transformer is the first butyl-molded transformer designed for 5000-volt outdoor application. This revolutionary design has virtually eliminated maintenance. **CORROSION-RESISTANT** materials are used in all exposed metal parts. The case and primary bushing are butyl rubber. The butyl also serves as insulation and as an important factor in the new Type JKW-3's high mechanical strength.

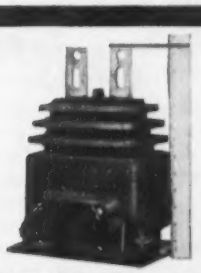
EASIER TO INSTALL, this new G-E current transformer can be mounted in any position for bottom-, side-, or top-connected installations. The lightweight and smaller size facilitates installation and handling.

ACCURACY CLASSIFICATION of the Type JKW-3 transformer is 0.3 at burdens: B-0.1 to B-2.0. Ratings are from 10 to 800 amperes.

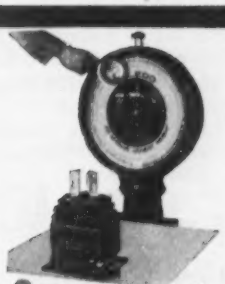
FOR MORE INFORMATION, contact your nearest G-E Apparatus representative, or write for Bulletin GEC-1222 to: Section 604-40, General Electric, Schenectady 5, N. Y.



1 BUTYL-MOLDED



2 COMPACT
only 12¾ in. high



3 LIGHTWEIGHT
only 42 lbs.

GENERAL ELECTRIC

Volseal...

the new high dielectric putty...

makes sealing easier!

New Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

Johns-Manville
SEALING COMPOUNDS

in September. August was 103,901.

Copper deliveries to fabricators was about 97,550 tons in October, up from 89,198 tons in September, which was another year's low.

Producers stocks of refined copper amount to 32,515 tons for October, marking another year's low; under 47,666 tons in September and 58,387 tons in August.

Outside the U. S., primary copper production was 139,656 tons in October, up from 125,158 tons in September, and 122,656 tons in August. Refined copper production was 104,396 tons in October, compared to 107,489 tons in September and 100,437 tons in August. Deliveries to fabricators totalled 107,193 tons in October, down from 110,234 tons in September, and up from 103,405 tons in August. Producers refined stocks amounted to 177,917 tons in October, up from 172,048 tons in September and 172,326 tons in August.

MANUFACTURING BRIEFS

Industrial Crane & Hoist Corp is occupying enlarged office and plant facilities at 1536 S. Paulina St, Chicago 8, Ill. With 160,000 sq ft of space and new equipment, manufacturing capacity is doubled for its expanded line of cranes.

Westinghouse Electric Corp will hold a directors meeting in Houston, Texas, on Dec. 1. This is the first meeting of the Westinghouse board of directors to be held west of the Mississippi.

Copperweld Steel Co received the bronze "Oscar of Industry" from Financial World for having the best annual report of the small steel companies.

Pittsburgh Reflector Co of Pittsburgh and Holden Lighting Manufacturers, Ltd, of Toronto have merged. The move is expected to strengthen both companies in their particular marketing areas.

International Business Machines Corp dedicated its multi-million dollar plant at Greencastle, Ind. The plant has 184,000 sq ft of maple flooring, ribbon glass windows, and 19,000 ft of fluorescent lighting; air conditioning and humidification; and a cafeteria and recreation area.

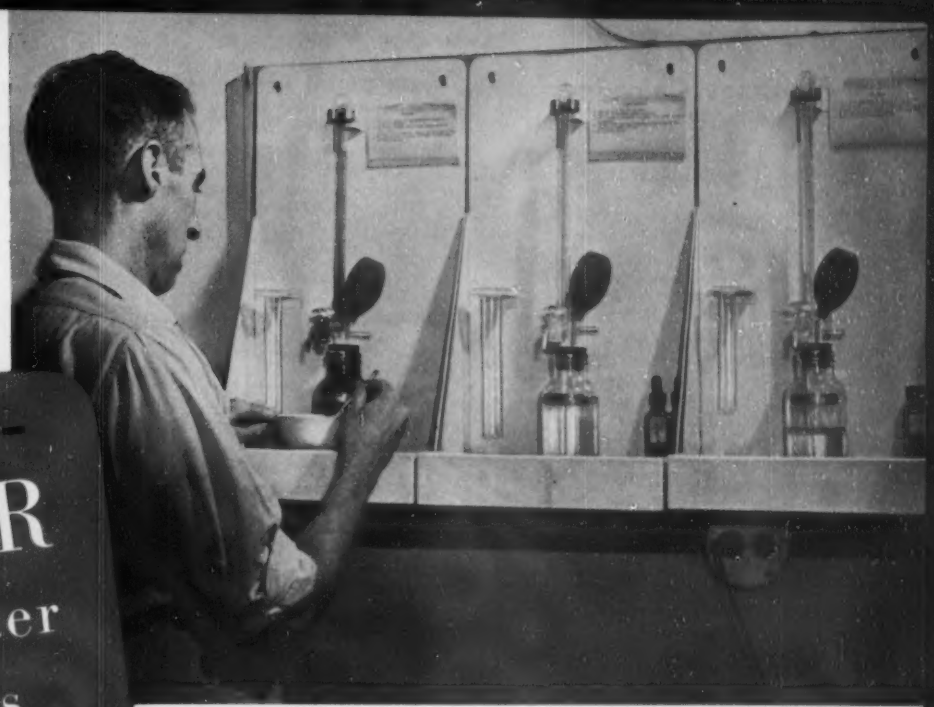
Mathias Klein & Sons has just moved to 7200 McCormick Rd, Chicago 45, Ill. The new plant has 110,000 sq ft of space in a single-story design.

Tokyo Shibaura Electric Co, Ltd, has opened an office in Bogota, Colombia, in anticipation of increased sales of power generating equipment in South American countries.

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Share 1954	Earnings Per Share 1953
Aluminum Co of America	9	Sept 30	$30,761,101	$40,141,929	2.88	3.90
Anaconda Copper Mining	9	Sept 30	19,171,803	24,156,882	2.21	2.78
Anaconda Wire & Cable	9	Sept 30	3,461,714	4,992,820	4.10	5.92
Babcock & Wilcox	9	Sept 30	11,376,000	9,501,000	7.31(a)	6.41(a)
Baldwin-Lima-Hamilton	9	Sept 30	2,656,172	5,519,786	0.62(a)	1.15(a)
Bethlehem Steel Corp	9	Sept 30	84,453,837	93,525,340	8.30	9.25
Blaw-Knox Co	9	Sept 30	3,141,142	3,056,927	2.07(a)	2.17(a)
Combustion Engineering, Inc	9	Sept 30	4,579,100	5,585,100	4.50	5.49
Copperweld Steel Co	9	Sept 30	665,302	2,443,353	0.93	4.38
Driver-Harris	3	Sept 30	63,440	152,412	0.71	1.71
E. I. du Pont	9	Sept 30	223,797,063	172,829,089	4.74	3.62
Fairbanks, Morse & Co	9	Sept 30	1,710,879	.....(c)	1.41	....
Foster Wheeler Corp	9	Sept 30	3,248,312	1,422,870	5.61	2.50
General Cable Corp	9	Sept 30	3,562,925	3,906,231	1.58	1.76
Ingersoll-Rand Co	9	Sept 30	17,420,000	15,632,000	8.62	7.73
International Nickel	9	Sept 30	47,430,561	41,252,680	3.15	2.72
Kennecott Copper Corp	9	Sept 30	57,973,802	65,545,066	5.36	6.06
McGraw Electric Co	9	Sept 30	8,251,000	5,160,000	8.04(a)	5.09(a)
Minnesota Mining & Mfg	9	Sept 30	17,594,981	13,708,826	2.11	1.63
Phelps Dodge Corp	9	Sept 30	29,517,069	27,900,835	2.91	2.75
Philco Corp	9	Sept 30	2,275,000	15,418,000(e)	0.53	4.01(b)
Rome Cable Corp	6	Sept 30	412,000	933,000	0.82	1.87
Sangamo Electric Co	9	Sept 30	1,172,172	1,633,077	1.47(a)	2.04(a)
Square D Co	9	Sept 30	3,134,428	3,228,578	2.28	2.35
Standard Oil Co of Ind	9	Sept 30	81,444,000	88,634,000	5.24(d)	5.76
Sylvania Elec. Products	9	Sept 30	6,166,226	7,562,941	1.93	2.48(f)
U. S. Hoffman Machinery	9	Sept 30	456,680	434,973	1.44	1.35
U. S. Rubber	9	Sept 30	20,084,571	21,488,326	3.05	3.32
Westinghouse Elec. Corp	9	Sept 30	62,644,000	53,219,000	3.77	3.26

Note—(a) Based on number of shares outstanding at close of the period. (b) Based on number of shares now outstanding. (c) Not available. (d) Based on average number of shares. (e) Includes non-recurring income of $5,316,000 from sale of television station and prior year's adjustments. (f) Adjusted to reflect 10% stock dividend distributed in December 1953.



Continuous laboratory testing and special treatment of water make possible Victor *Purified* Porcelain

Another Reason Why—

VICTOR Makes Better Insulators

Victor manufactures many special shapes in addition to a complete line of standard porcelain for transmission and distribution.

ONLY VICTOR MAKES

PURIFIED PORCELAIN

Many milestones in insulator progress have been due to VICTOR research. But none is as important as its development of *Purified* Porcelain. By specially treating the water used in the manufacture of VICTOR Insulators and employing many other ceramic advances, VICTOR gives you the finest insulator porcelain ever made—porcelain which, for the first time in the industry, is *pure* porcelain all the way through!

Purified Porcelain has vastly greater uniformity in mechanical and electrical strength values, higher mechanical impact and puncture voltage values, greater density, hardness and permanence than any other insulator porcelain. That's why more and more power men are specifying VICTOR *Purified* Porcelain Insulators.

Specify

VICTOR *PURIFIED* PORCELAIN INSULATORS

VICTOR INSULATORS, INC., VICTOR, N. Y.
SUBSIDIARY OF I-T-E CIRCUIT BREAKER CO.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators
Custom Designed Porcelain

Meetings Calendar

(*Continued from page 71*)

PUBLIC UTILITIES ADVERTISING ASSOCIATION

Annual Meeting, Region 2, St. Moritz-on-the-Park, New York, Dec. 2-3.

21ST NATIONAL POWER SHOW

Sponsored by American Society of Mechanical Engineers, Commercial Museum, Philadelphia, Dec. 2-7.

INTERSTATE POWER CLUB

Meeting at Hotel Martinique, New York, Dec. 6.

EASTERN JOINT COMPUTER CONFERENCE EXPOSITION

Sponsored jointly by American Institute of Electrical Engineers, Institute of Radio Engineers, and Association for Computing Machinery, Bellevue-Stratford Hotel, Philadelphia, Dec. 8-10.

NORTHEASTERN WEED CONTROL CONFERENCE

Annual Meeting, New Yorker Hotel, New York, Jan. 5-7, 1955.

ELECTRICAL EQUIPMENT REPRESENTATIVES ASSOCIATION

Annual Meeting, Breakers, Palm Beach, Fla., Jan. 10-12, 1955.

DOBLE ENGINEERING CONFERENCE

22nd Annual Meeting, Sheraton Plaza, Boston, Jan. 24-28, 1955.

***PACIFIC COAST ELECTRICAL ASSOCIATION**

Business Development Section, Hotel Californian, Fresno, Calif., Jan. 27-28; Conference on Electronic Integrated Data Processing, Hotel Statler, Los Angeles, Feb. 23-24; Engineering and Operating Section Conference, Hotel Huntington, Pasadena, Calif., March 7-8; Joint Conference with Pacific Coast Gas Association, Administrative Services and Accounting Section, Jokane Inn, Phoenix, Ariz., April 7-8; Hawaiian Section Conference, Honolulu, Nov. 9-10, 1955.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Winter General Meeting, Hotel Statler, New York, Jan. 31-Feb. 4; Southern District No. 4, St. Petersburg, Fla., April 13-15; Middle Eastern District No. 2, Columbus, May 4-6; Summer General Meeting, New Ocean House, Swampscott, Mass., June 27-July 1; Fall General Meeting, Morrison Hotel, Chicago, Oct. 3-7, 1955.

MISSOURI VALLEY ELECTRIC ASSOCIATION

Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 3-4; Engineering Conference, President Hotel, Kansas City, Mo., March 23-25, 1955.

***PENNSYLVANIA ELECTRIC ASSOCIATION**

Winter Meeting, Relay Committee, Hotel Roosevelt, Pittsburgh, Feb. 3-4; Winter Meeting, Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 17-18, 1955.

NATIONAL ASSOCIATION OF PURCHASING AGENTS

24th Annual Mid-Winter Conference, Public Utility Buyers' Group, Shamrock Hotel, Houston, Tex., Feb. 13-15, 1955.

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

Annual Meeting, Convention Hall, Atlantic City, N. J., Feb. 14-17, 1955.

SOUTHERN SAFETY CONFERENCE-EXPOSITION

Jung Hotel, New Orleans, La., Feb. 27-March 1, 1955.

***ROCKY MOUNTAIN ELECTRICAL LEAGUE**

Electric Meter Institute, University of Denver, Denver, Colo., March, 1955; Annual Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 17-19; Fall Convention, Grand Teton Lodge, Jackson, Wyo., Sept. 11-14, 1955.

NORTH CENTRAL ELECTRIC ASSOCIATION

Sales Committee Meeting, Radisson Hotel, Minneapolis, Minn., March 6-9, 1955.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Annual Convention, Palmer House, Chicago, March 7-11, 1955.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

Edgewater Beach Hotel, Chicago, March 13-18, 1955.

SOUTHEASTERN ELECTRIC EXCHANGE

Annual Meeting, Boca-Raton Hotel and Club, Boca Raton, Fla., March 21-23, 1955; Engineering and Operation Section, Roosevelt Hotel, New Orleans, La., April 7-8, 1955.

OKLAHOMA UTILITIES ASSOCIATION

Annual Convention, Mayo Hotel, Tulsa, Okla., March 24-25, 1955.

***CONTROLLERS INSTITUTE OF AMERICA**

Southern Conference, Mayo Hotel, Tulsa, Okla., March 25-26; Eastern Conference, Royal York Hotel, Toronto, Ont., April 28-30, 1955.

AMERICAN POWER CONFERENCE

17th Annual Meeting, Sherman Hotel, Chicago, March 30-31, April 1, 1955.

***ILLUMINATING ENGINEERING SOCIETY**

Southern Regional Conference, Ft. Harrison Hotel, Clearwater, Fla., March 31-April 1; Southwestern Regional Conference, Gunter Hotel, San Antonio, Tex., April 3-5; Southern Pacific Coast Regional Conference, Statler Hotel, Los Angeles, April 14-15; Pacific Northwest Regional Conference, Harrison Hot Springs Hotel, Harrison Lake, B. C. April 25-26, 1955.

***NATIONAL TELEMETERING CONFERENCE-EXHIBIT**

Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers, Institute of Aeronautical Sciences, Instrument Society of America, Morrison Hotel, Chicago, May 18-20, 1955.

AMERICAN SOCIETY FOR TESTING MATERIALS

Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N .J., June 26-July 1, 1955.

***PRODUCTION ENGINEERING SHOW**

Navy Pier, Chicago, Sept. 6-17, 1955.

INTERNATIONAL ASSOCIATION OF ELECTRICAL LEAGUES

Annual Convention, Toronto, Ont., Oct. 5-8, 1955.

*Additions this week.

SALES ASSIGNMENTS

COMPANY STAFFS

Cochrane Corp, Philadelphia, has made Joseph R. Denton manager of its newly opened New York district sales office at 261 Madison Ave., New York City. For the past 14 years Denton has served with Worthington Corp.

Hubbard & Co has announced these appointments: Leonard P. Schafer was made Southeastern sales manager. Assisting him will be M. E. Harrison in Florida; J. H. Awtry, Alabama and Georgia; W. J. Meinert, Ohio and southeastern Michigan; W. W. Ege, Jr, Kentucky, southwestern Ohio, southern Indiana, and central and eastern Tennessee. John C. Carroll, Jr, was appointed Midwest sales manager. He will personally cover northern Illinois and will be assisted by: LeRoy A. Ehmsen in Iowa and eastern Nebraska; F. G. Lanick, North and South Dakota, Minnesota, western Wisconsin, and eastern Montana; William Calog, eastern Wisconsin and central Illinois; and Roy E. Peterson in northern Indiana and Michigan. New Southwest sales manager is Don V. Cole, who will personally cover Arkansas, southern Illinois, northern Mississippi, western Tennessee, and eastern Missouri. Assisting Cole will be G. T. Brundett in Texas; Earl C. Nelson, Kansas, Oklahoma, and western Missouri; James A. Wills, Louisiana and southern Mississippi; and Wallace E. Stroberg, New Mexico, Colorado, western Nebraska, and southeastern Wyoming.

Sylvania Electric Products, Inc, has announced several changes for its Lighting Division. Robert C. Harper was made Western regional sales manager for lighting with offices in San Francisco. The Western sales region in lighting comprises California, Washington, Oregon, Montana, Idaho, Utah, Nevada, and Arizona. Harper's move was accompanied by the transfer from Emeryville, Calif., of William L. Friend to Los Angeles as district sales manager. Friend's former post as district sales manager for San Francisco will be filled by Robert W. Thunen, district engineer at Emeryville. In another divisional appointment, Donald M. Canfield was promoted to district sales supervisor for lighting products of the Cleveland (Ohio) area. Canfield, who joined Sylvania in 1948, will make his headquarters at the company's new warehouse and sales office at 4848 W. 130th St., Cleveland.

American Blower Corp, Dearborn, Mich., has reassigned two field employees to newly opened direct factory branch offices at Portland, Ore., and Fort Wayne, Ind. W. S. Cooper was transferred from the firm's office at Charlotte, N. C., to Portland to manage the new office, which is located at Pittock Block, 921 SW, Washington St. Formerly a sales engineer at American Blower's South Bend office, J. W. Johnson was made manager of the Fort Wayne office, 517 Gettle Bldg., which will serve the northeastern section of Indiana.

Anaconda Wire & Cable Co, New York, has appointed Ernest B. Miller, Jr, as district manager for the Chicago sales district. John N. Ratcliff, Jr, takes over Miller's former post of district manager for the Houston sales district.

Electric Controller & Manufacturing Co, Cleveland, has appointed I. H. Peak as Philadelphia district manager. Peak, who has been a member of that sales office for the past several years, succeeds Henry K. Hardcastle, who retired recently after 30 years in that capacity. David R. Ward has joined the Philadelphia sales office. Prior to joining Electric Controller he was engaged in industrial electric sales work and in steel mill engineering services.

REPRESENTATIVES

Standard Transformer Co, Warren, Ohio, has announced these appointments: J. L. Howarth Co, 2550 Beverly Drive, Birmingham, was made the firm's exclusive representative in Alabama and Georgia. Charles L. Ward Co was named exclusive representative in Iowa and Nebraska. The Ward firm maintains offices at 5707 Waterbury Circle, Des Moines, Iowa, under the managership of George Swallow; and at 502 Grove Ave., Corning, Iowa, which is managed by Joseph Connolly.

Protect

YOUR LINEMAN
AS WELL AS
YOUR LINE WITH

BLACKBURN Aluminum FITTINGS

Time-Tested in Field Operation

NO HAZARDOUS TOOLS REQUIRED

When that storm emergency call comes through, linemen appreciate the easy, safe way they can install BLACKBURN Aluminum Fittings with their standard hand tools.

Engineers and operating men can specify BLACKBURN Aluminum Fittings with confidence because they:

- Protect conductors, by distributing unit pressures over large area.
- Provide wide separation of dissimilar metals—insuring against galvanic corrosion.
- Are made with corrosion resistant alloys.
- Are time tested in field operation under all weather conditions.
- Available in varied designs as illustrated.

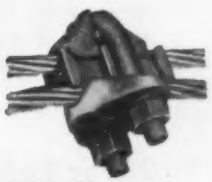
Send for free literature and samples

Available through electrical wholesalers everywhere

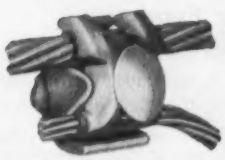
JASPER BLACKBURN CORPORATION
35 Madison St. • St. Louis 6, Mo. • Phone: CEntral 3007

TYPE PAA-400
For Aluminum Conductors through 400 MCM

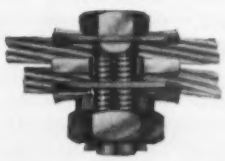
TYPE PAC—For Aluminum Conductors through 336.4 MCM; Copper through 2 str.



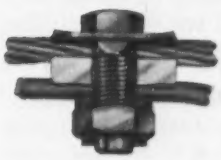
TYPE DLC—For Aluminum Conductors through 1/0 ACSR



TYPE PAA—For Aluminum Conductors through 336.4 MCM

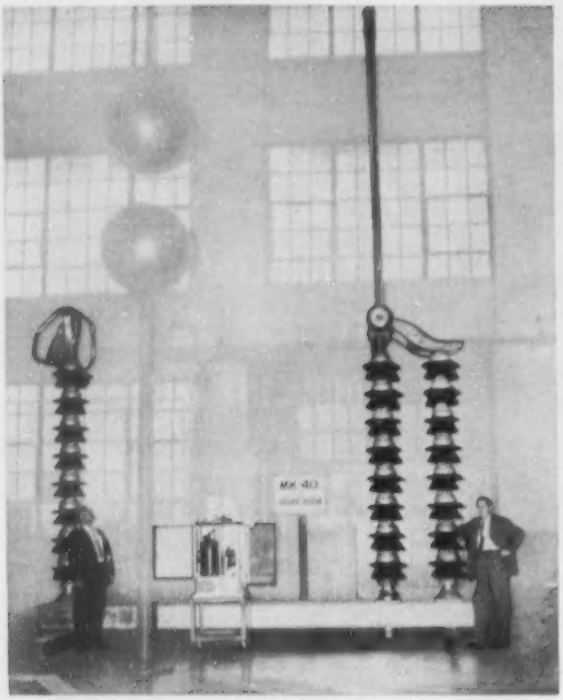


TYPE AAW—For Aluminum Conductors through 4/0 ACSR



TYPE CA—For Aluminum Conductors through 4/0 ACSR; Copper through 4/0

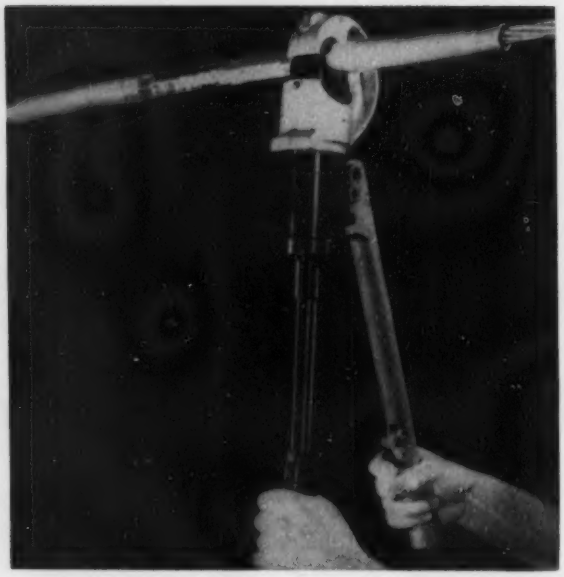
NEW EQUIPMENT



380 KV Switch

Switch rated 380 kv has a BIL impulse level of 1,470 kv. The switch has been tested for corona, radio influence voltage values, current carrying ability, and 60 cps and impulse dielectric levels. Current capacity of this MK-40 switch is 1,600 amp. Total height of open switch is about 28 ft. The switch is illustrated with SK motor mechanism used for driving one 3-pole switch.

Delta-Star Electric, 2437 Fulton St, Chicago 12, Ill.



Compressor

Hand compressor tool has 12-ton thrust for installing accessories on ACSR and aluminum conductor as large as 350,000 cm. Designed primarily of use on distribution line conductors, this 11-lb tool is operated without removing hands from the tool handles. The opening between press dies is closed by a twist of one handle.

The C-head, which holds the dies, can be rotated 180 deg to facilitate operation in limited space. Tool uses nylon pump packing and integral pressure relief valve. The compressor will be available with or without insulated body and handles. It may also be used with hot sticks.

Aluminum Company of America, 1501 Alcoa Bldg, Pittsburgh 19, Pa.

Oxygen Analyzer For Feedwater

Dissolved oxygen analyzer, Model 2B2B, continuously measures and records dissolved oxygen concentration in boiler feedwater. Range is 0-20 parts per billion, adjustable to 0-200 parts per billion. Accuracy is 5% of reading.

Analyzer consists of sample flow regulating an ion exchange unit, analysis unit, and a modified recorder. Components may be in a portable stand or panel mounted.

Principle of measurement is based on oxidation of nitric oxide in water solution by dissolved oxygen to nitrogen dioxide, which in turn reacts with water to form nitric and nitrous acids. The acid produces an increase in conductance of the water, directly related to the oxygen concentration in the sample.

Arnold O. Beckman, Inc, 1020 Mission St, South Pasadena, Calif.

2-Way Radio

Packaged 2-way radio system has extra power to overcome high audible noise levels. System consists of receiver, transmitter, and power supply with audio booster amplifier. It operates interchangeably with either a 6- or 12-v battery installation. Audio output is 10 w; rf output is 25 w. Speaker is waterproof, marine type. It may be fixed or swivel mounted.

Motorola Communications & Electronics, Inc, 4501 W. Augusta Blvd, Chicago 51, Ill.

Supervisory Control

Digital supervisory control system is designed for remote measurement and for such control functions as remote shaft positioning, on-off switching, and proportional control. The system, known as Electro-Span, may be used with telegraph circuits, telephone lines, VHF radio, or microwave links. Voice communication can be time shared.

Accuracy is claimed to be unaffected by frequency drift, phase shift, voltage drop, and internal or external noise. Plug-in units and building block design allow many variations of installations.

The Electro-Span remote tank gaging system provides remote measurement of liquid level to 60 ft in ⅛-in.

(*Continued on page* 144)

IT HOLDS!

Like "A Steel Hand in a Velvet Glove!"

Hubbard Guy Clamps exert a full and even pressure on the guy for the full length of the clamp.

The straight grooves fit any and all twists, right or left hand, and any variation in diameter, without creating high spots or lessening the clamping area.

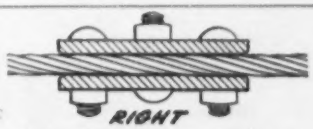
There are no sharp edges, and the grooves are smoothly bell-ended, to protect the strand from injury at all points.

High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening, and the whole clamp is given maximum resistance against corrosion by the famous Hubbard Double-Dip Hot Galvanizing process.

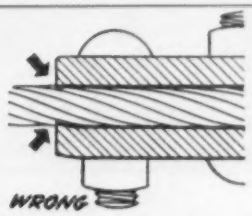
Clamping area reduced by warped section. Causes slippage at low strains. (Illustration slightly exaggerated)

Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

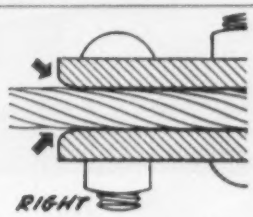
High spots in clamp reduce clamping area, cause slippage and injure strands.



Hubbard Clamps fit snugly over any and all twists right or left and variations of diameter.



Sharp edge from sheared section injures and weakens the guy at end of clamp.

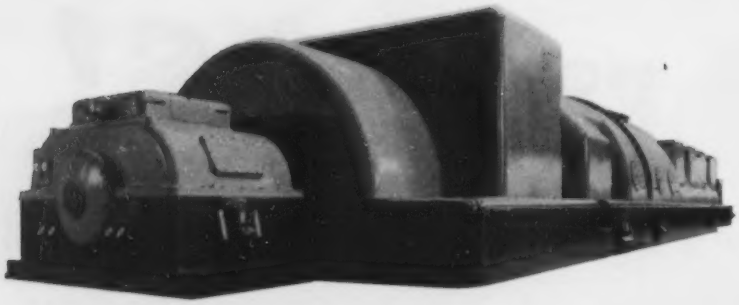


Rounded ends of Hubbard Clamp sections protect strand.

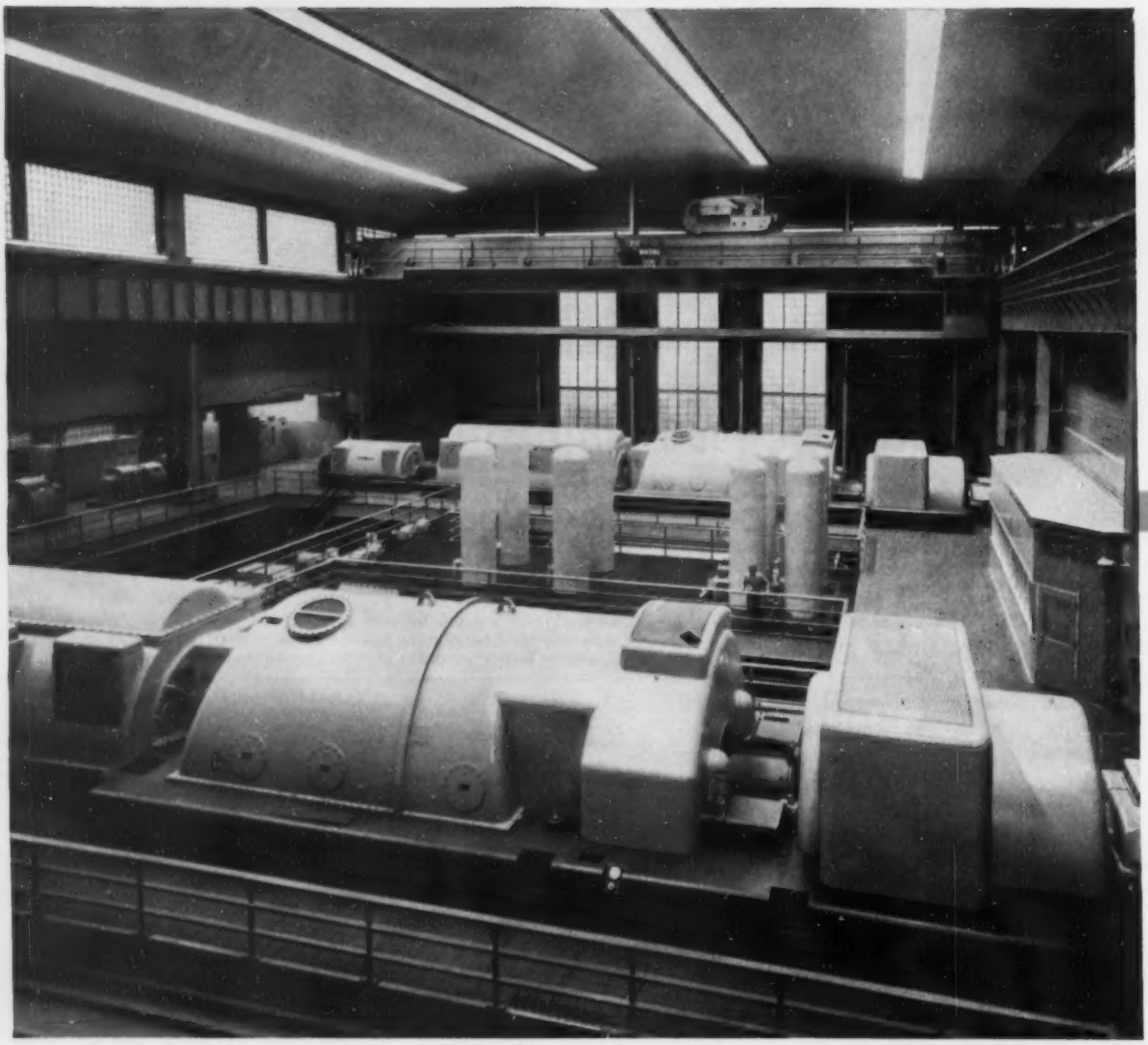
HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"



Hottest



Two General Electric 145,000 Kw tandem-compound, triple-flow turbine-generator units at the New Kearny Generating Station of Public Service Electric and Gas Company (New Jersey). They are designed for steam conditions of 2350 psig; 1100 F initial, and 1050 F reheat. At the top is a close-up of one of these high-temperature turbines at the New Kearny Generating Station. These two units produce enough electric power to supply a city of 800,000 people.

steam turbines in the U.S. get effective, long-lasting lubrication with GULFCREST OIL

Driven by steam so hot that the stainless steel pipes carrying it glow dark red and with their huge turbine rotors spinning at 3600 rpm, this country's hottest steam turbines require safe, long-lasting lubrication.

Entrusted with the vital job of providing this kind of lubrication is Gulfcrest—the oil that is super-refined by Gulf's exclusive Alchlor Process.

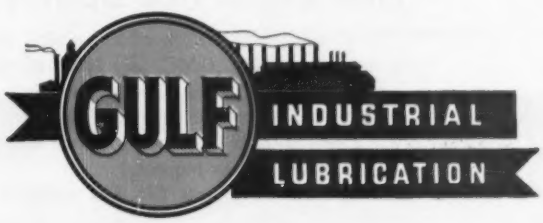
Gulfcrest Oil's unmatched record of outstanding performance in every type and make of steam turbo-generator is a guarantee of efficient protection for the nation's hottest units for many years to come.

The next time you fill a turbine system, make it a fill for the most effective, longest-lasting protection. Specify Gulfcrest—the world's finest turbine oil. Call your nearest Gulf office today and have an experienced Gulf Sales Engineer recommend the proper grade.

GULF OIL CORPORATION

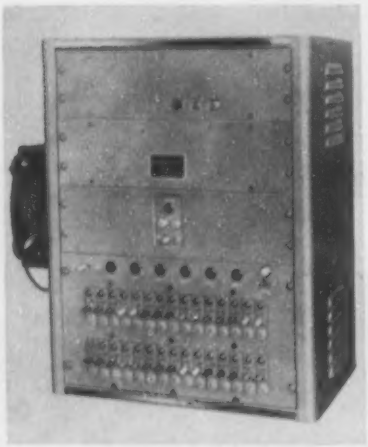
GULF REFINING COMPANY

1822 Gulf Building, Pittsburgh 30, Pa.



New Equipment

(*Continued from page* 140)



increments. System allows selection of a given tank, and tank self-identification. The information, coded in digital form, is transmitted to the central control station via the remote tank selector.

The tone signal control system performs remote on-off control functions, alarm circuits, automatic pre-set fail-safe controls, system continuity test, and time-shared telephone. Automatic repeat-back confirmation of performance is provided.

Pacific Div, Bendix Aviation Corp, 11600 Sherman Way, North Hollywood, Calif.

Mobile Radio

Mobile two-way radio rated 25 w for 152-174 Mc band replaces two older 10-w models. The new model operates from either a 6 or 12 v system.

Units are convertible to split-channel operation without addition of new components. Size is identical to previous 10-w models. To changeover from 6 to 12 v operation two connector plugs are rotated, and fuses and pilot lights changed.

General Electric Co, Electronics Park, Syracuse, N. Y.

DC Generators

Three electric generating plants are designed for magnet service in industrial plants and scrap yards.

Model 10CW-15OR is a remote starting unit rated 40 amp, 250 v dc. Prime mover is a 2-cylinder, opposed, air-cooled "CW" engine. The magnet-service generator with drooping voltage characteristic is direct connected to engine.

Two water-cooled engine plants are in 10,000 and 15,000 w sizes. Model 10HQ-150R will deliver 40 amp, 250 v. Model 15HQ-150R delivers 60 amp, 250 v. Both are remote starting. Weight is 1,075 lb. Catalog sheets give full specifications.

D. W. Onan & Sons Inc, Minneapolis 14, Minn.

Dust Collector

Centrifugal dust collector using outside-in twist is claimed to give higher efficiency over a wide range of air volumes. The outside-in twist reverses the normal tangential flow. The conical inlet imparts a swirling motion to dust particles, while permitting clean air to travel through the tube without changing direction, the manufacturer claims.

Suggested use is for trapping fly ash in plants burning pulverized coal. These AMERclone units are usable to 750 F, but special materials may be employed for higher temperature applications. Pressure drop is 4½ in. Details are in Bulletin 291.

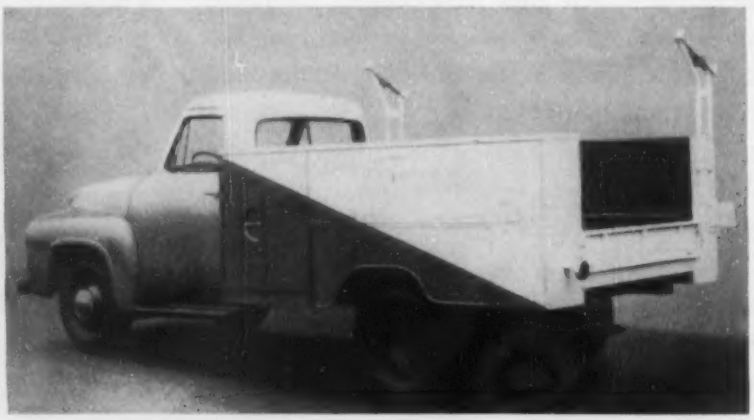
American Air Filter Co, Inc, Louisville 8, Ky.

Linear Thermometer

Vapor-pressure actuated thermometer systems record on uniform charts. A varying-ratio linkage converts the non-linear vapor pressure-temperature curve into linear deflection of the recording pen.

The thermometers are claimed to be free from ambient temperature effects, have fast response, high torque, small bulb size, and simple control attachments for use with gas or liquid filled systems. These Class 2 thermometers

(*Continued on page* 146)



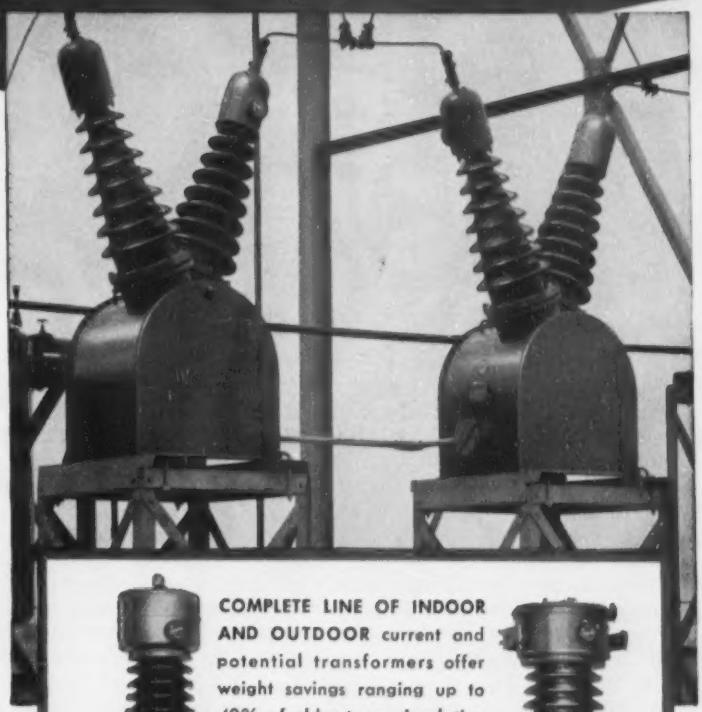
Line of Service Bodies

Line of service bodies offers models to fit 40 different Chevrolet, Ford, Dodge, Studebaker, GMC, and International Chassis—½, ¾, 1 and 1½ tons—single or dual wheel. Bodies have new design, engineering materials, and production methods. Bonderized, all-steel welded construction with double lap-type joints is used. Eighteen different compartment arrangements are offered. Full specifications on request.

Morrison Steel Products, Inc, 601 Amherst St, Buffalo 7, N. Y.

These potential transformers weigh 800 lbs less than older types

SAVE TIME...SAVE SPACE ...SAVE STRUCTURE



ALL THAT IS NEEDED to lift these 69-kv potential transformers into place is a set of rope blocks — thanks to the savings in weight made possible by new Allis-Chalmers designs. In addition, they take up less space, require less foundation structure than other types of potential transformers.

Corona-Free Design Provides High Insulation Strength

The units are corona-free. They have high insulation strength and high thermal ratings. Long-time overvoltage tests have proved all voltage classes.

Construction Sturdy

Tanks are all-welded, hermetically sealed to protect insulation and oil from sludge formation. Unique bushing construction permits circulation of oil through the bushing and transformer, reducing oil requirements and permitting reduced transformer sizes.

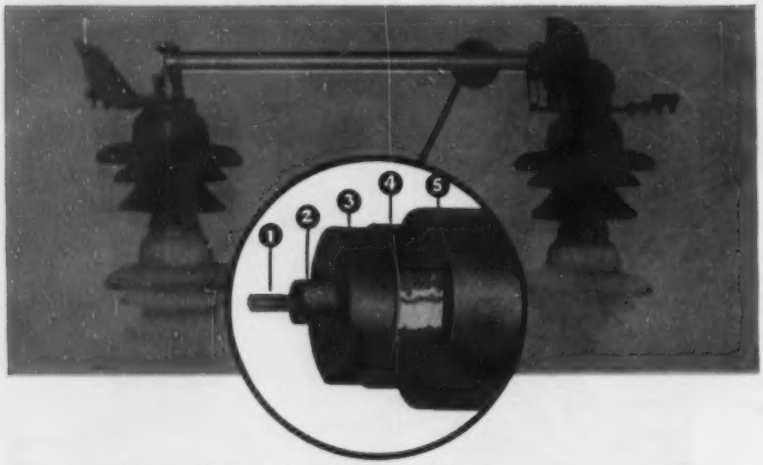
It will pay to get all the facts on weight savings and quality design and construction of Allis-Chalmers current and potential transformers. For your copy of the technical paper "PT's Are Getting Smaller," consult the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4483

COMPLETE LINE OF INDOOR AND OUTDOOR current and potential transformers offer weight savings ranging up to 40% of older types. Insulation strengths are greater and thermal ratings higher than could previously be provided.

ALLIS-CHALMERS

USCO's New High Voltage Fuse Eliminates Corona from Fuse Links. Lasts Many Times Longer than Ordinary Open Type Fuses



Frequent inspections and replacements in most cases are no longer necessary. This new, expulsion fuse cuts down heavily on high service costs, quite frequently eliminates need for expensive oil circuit breakers, chemical or liquid type fuses.

This is accomplished by transferring the electro-static discharge from the surface of the fuse link to the outer surface of the fuse tube. The resistive layer (#4 on diagram) reduces the potential difference between the fuse link and the outer surface of the tube to practically zero. This reduction substantially eliminates the corona ordinarily present around the fusible elements of the fuse link, thus preventing corrosion and extending the life of the fuse link to many times that of ordinary fuses. Life of the fuse tube is also extended because the cause of damage to the fiber liner is eliminated.

Structure: The improved fuse-link tube structure includes an internal cylindrical fiber liner (2) extending between end terminals and through which the fuse link (1) passes. A relatively thick cylindrical body (3) of Laminated Phenolic surrounds the fuse link and the horn fiber liner. A layer of electrically resistive material (4) having a high value of resistivity covers the entire exterior surface of the body. An external layer (5) of Laminated Phenolic provides a protective insulating wrapper. USCO's corona-resistant fuse tubes are adaptable for use in all expulsion type fuses 46 through 161 KV.

For Details Contact Our Nearest Representative or Factory.

Another New Development in Electrical Power Transmission Equipment by

USCO

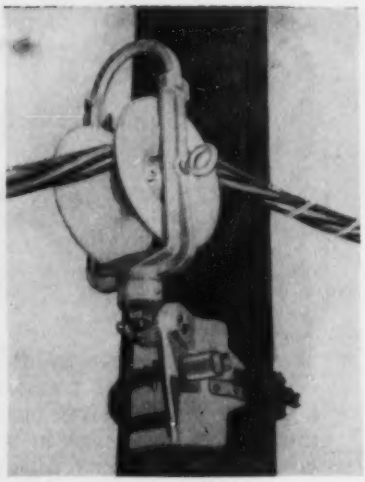
USCO Power Equipment Corp.

829 North 36th Way, Birmingham 4, Alabama — Phone 59-7241

Designers and manufacturers of high voltage electrical equipment.

use a dual-filled system for cross ambient ranges, and dual-filled, linear systems are used for ranges under 200 F.

Bristol Co, Waterbury 20, Conn.



Cable Pulley

Aluminum alloy cable pulley weighs less than 25 lb and can be placed by one man. It requires 8 in. of pole length, and will carry a load of 600 lb. Maximum size conductor for 100-ft spans is 4/0 3-conductor preassembled aerial cable.

The lineman positions the pulley by hand, and tightens with standard lineman's wrench. The arched safety bar has a finger-tip snap latch.

Maxwell Equipment Co, Milford, Conn.

Wiring Duct

Underfloor distribution system, Powerduct, is furnished in 10-ft lengths. It is installed with junction boxes, couplings, and self-leveling supports on form, slab, or fill prior to pouring finished floor. Pre-set inserts in duct provide evenly spaced outlet points for standard connections to machines or equipment. Duct has 17 sq in cross-sectional area. Cables up to 500,000 cm are accommodated.

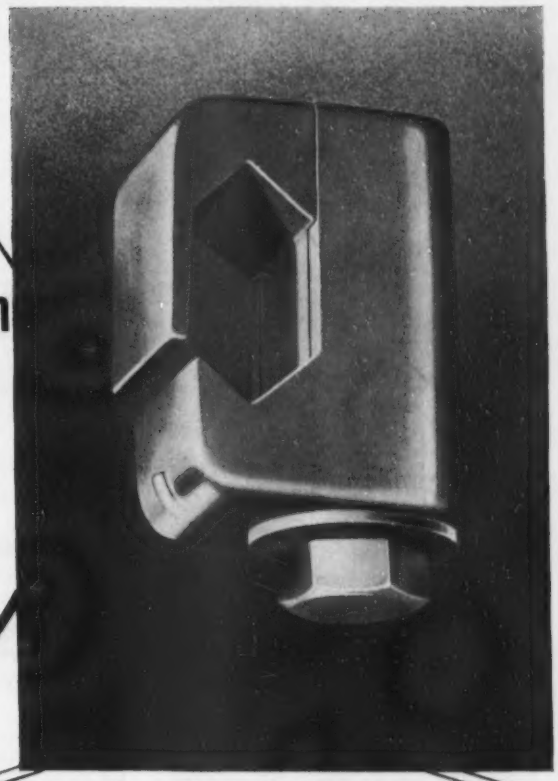
Duct is made of 14 ga steel, electric-welded seam, and protected with a layer of Sherardized zinc, and covered with Dualcote.

Walker Brothers, Conshohocken 37, Pa.

(*More New Equipment on page* 148)

FARGO CONNECTORS

for Ease of Installation
Higher Conductivity
Overall Economy
Wide Range
Safety
• • •
• •



"one-piece" . . . "vise-type" Connectors

Fargo Connectors *grip like a vise* to give an ideal . . . vibration-proof contact—high in conductivity . . . with high compression at low wrench torque. They are easy and safe to handle . . . require no attention after installation—and can be used over and over again. Ask your Line Material Field Engineer to give you the complete details on Fargo Connectors and other time and labor saving devices in the Fargo line.

Approved by Underwriters' Laboratories, Inc.

"One-Piece" Fargo Connectors Are Easy To Use

1st. HOOK ON RUN

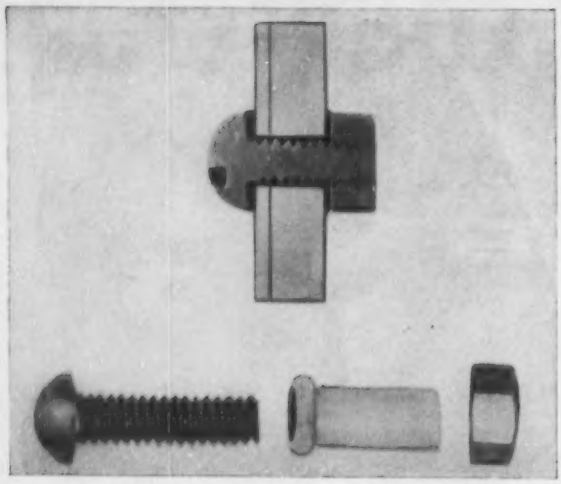
2nd. INSERT TAP

3rd. TIGHTEN BOLT

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N.Y.

Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin



Nylon Bolt Sleeve

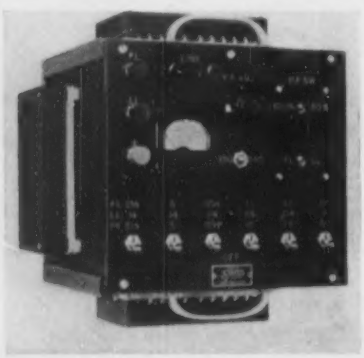
Nylon sleeve for bolts is claimed to reduce bolt failure due to vibration, eliminate electrolytic corrosion, and provide a leak-proof seal. The Nyltite is a nylon sleeve which utilizes nylon's cold-flow properties for improved fastening and sealing with bolt, screw, or rivet.

A nylon washer vibration-proof, leak-proof sealing is formed when a short sleeve is used under the head of a bolt. A compressible sleeve (insulating bolt and nut from work material) is formed when a rim-flange sleeve is used to extend from bolt head to nut. The tendency for the nylon to resume its former shape maintains pressure on the bolt and nut to act as a lock washer. The sleeves can be used up to 250 F.

Keystone Plastics, Inc, 2331 Morris Ave, Union, N. J.

Phantom Load For W-Hr Meters

Type ID phantom load checks watthour meters up through 50 amp at 50% as well as 100% pf on single-phase supply. Output current is controlled by a set of switches that cut in fixed resistance.



Current steps for full and light load and 100% pf are: 0.25, 0.5, 1.25, 1.5, 2.5, 5, 12.5, 15, 25, and 50 amp. For 50% pf, steps are: 2.5, 5, 12.5, 15, 25, and 50 amp. Duty cycle is 3 min on, 5 min off. A 45-min duty cycle load is also available. Input is 120/240 v, 60 cps.

States Co, 3 New Park Ave, Hartford, Conn.

Current Transformer

Three new features have been added to Type JKP-O 600-v molded current transformers. Accuracy of the 200 amp model has been improved—it now meets 0.3 B-0.1 and 0.3 B-0.2 accuracy, same as the other three current ratings.

The 600 and 800 amp models now have 27/16-in. diam windows. The third feature is a primary-bar unit which can be inserted in the window.

General Electric Co, 1 River Rd, Schenectady, N. Y.

Meter Controller

Model 360 Meter Controller has isolated dpdt output relay contacts actuated when meter approaches or deviates from preset limits. The unit can be placed in series with standard movements of most indicating or recording instruments. The unit uses a low impedance, positive locking, contact meter movement for automatic control or monitoring.

Daytronic Corp, 216 S. Main St, Dayton 2, Ohio.

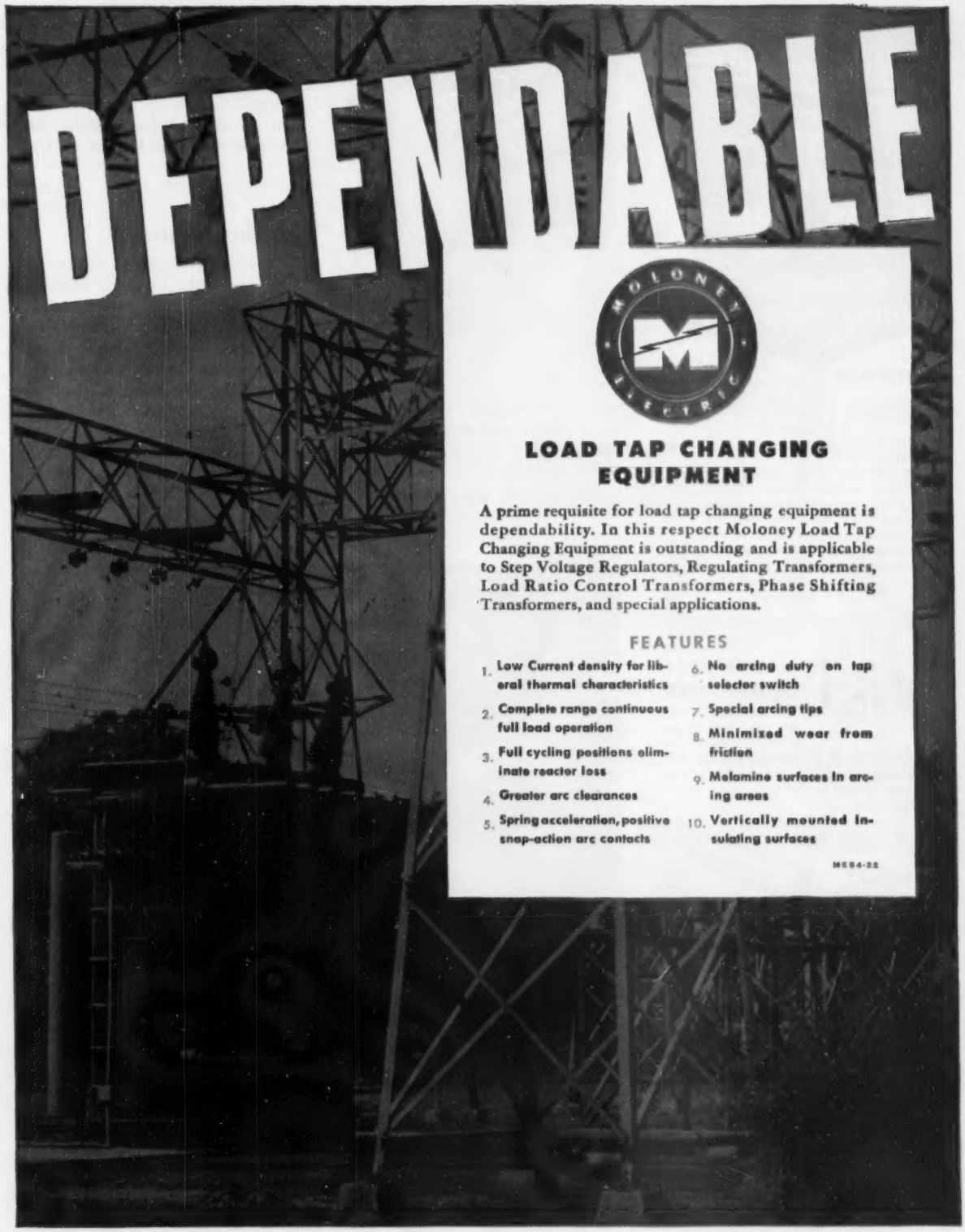
Digital Voltmeter

Digital voltmeter, Model 615, has a revolving three-digit counter instead of the conventional deflecting needle and multiple scales. Voltage, current, and resistance are directly read in the sensitivity ranges of 0.001 to 1,000 v, and from 1 ohm to 10 megohm. Accuracy is 1% on dc and ohms, 2% on ac. The digital voltmeter greatly reduces errors caused by parallax, interpolation, or reading of the wrong scale.

Hycon Manufacturing Co, 2961 E. Colorado St, Pasadena 8, Calif.

Governor

Load sensitive electro-mechanical governor, the DUPY, provides voltage and frequency regulation for gas or diesel engine-driven generators. DUPY has two main functions: It controls frequency of an alternator,



LOAD TAP CHANGING EQUIPMENT

A prime requisite for load tap changing equipment is dependability. In this respect Moloney Load Tap Changing Equipment is outstanding and is applicable to Step Voltage Regulators, Regulating Transformers, Load Ratio Control Transformers, Phase Shifting Transformers, and special applications.

FEATURES

1. Low Current density for liberal thermal characteristics
2. Complete range continuous full load operation
3. Full cycling positions eliminate reactor loss
4. Greater arc clearances
5. Spring acceleration, positive snap-action arc contacts
6. No arcing duty on tap selector switch
7. Special arcing tips
8. Minimized wear from friction
9. Melamine surfaces in arcing areas
10. Vertically mounted insulating surfaces

ME84-22

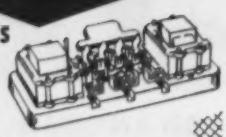
MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Recommended these METER TESTING ACCESSORIES Now in use by Leading Utility Companies

PHASEFORMERS



ACCURATELY MEASURES REACTIVE POWER: when properly connected to a watthour meter will provide for that meter the proper potentials lagging 90° in phase from the normal circuit potentials, together with a switching arrangement whereby the meter connected thereto can be checked as a straight watthour meter.

TYPE TRF RESISTANCE LOAD

The addition of a current operating fan on this item is to aid the natural draft condition and make possible a maximum capacity of 24 amperes load current at 240 volts in an aluminum case.

ROTARY TAP SWITCH

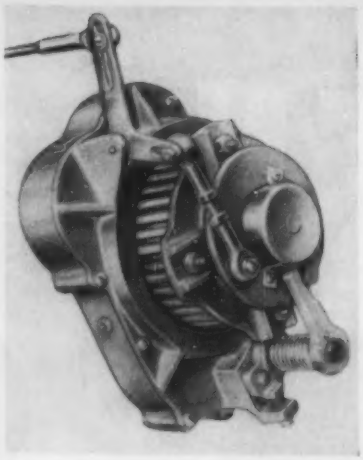
ALL INCLUSIVE FEATURES: high current capacity, non-arcing, high voltage capacity, inductive load capacity, numerous circuit combinations, special high current connections, positive action, compact design, fully enclosed.

METER TEST BOARD

So many requests have been received to provide a packaged, up-to-date, compact meter test board unit, we are presenting this equipment which has many features for efficient operation.

Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.



and it also regulates the voltage of a dc machine, both by controlling the speed of the prime mover.

The DUPY rotor is driven from the engine through gears to reduce the speed to 150 rpm. It holds frequency to ½%, dc voltage to 1%. Overall system response is about 2 sec, depending on engine condition. Request Bulletin T-8500.

Inet Division of Leach Corp, 4441 Santa Fe Ave, Los Angeles 54, Calif.

Braking Motor

Dynamic-braking, ac motors are rated to 30 hp. Dynamic braking is built into standard frame single or polyphase induction motors—two-phase brake winding is super-imposed on the standard stator winding. During braking one phase of the brake winding is connected to a single-phase line; the other phase is permanently short circuited. Ask for Form 3810.

Master Electric Co, 126-46 Davis Ave, Dayton, Ohio

5.2 and 7.8 Kv Cutouts

Line of enclosed fuse cutouts combines all available operating functions in one basic design. Fexibility is assured by one housing and four interchangeable doors in each voltage and current rating. Doors provide for normal duty indicating or dropout, normal duty indicating non-dropout, indicating heavy duty or extra heavy duty, and disconnect functions.

Broad-faced, high pressure V-wedge contacts are free-floating, self-aligning, and self-wiping. Mounting support is compression clamped to porcelain housing for mechanical strength.

Currently available voltage ratings are 5.2 and 7.8 kv, in continuous current ratings of 50 amp and in applicable NEMA interrupting ratings. The 100 amp, 5.2 and 7.8 kv cutouts will be available in early 1955.

General Electric Co, Distribution Department, Pittsfield, Mass.

MORE NEW PRODUCTS
about which you should know

Reliable Electric Co, 3145 Carroll Ave, Chicago 12, Ill. has Strandlink and Strandvise for **splicing and dead-ending** steel strand messenger, static, and guy wires, now made for 7/16-in. strand.

Hewson Company, Inc, 443 Broad St, Newark 2, N. J. has Safe-T-Ohm **automatic ground control** (Model G-5) that will stop a process in hazardous areas when ground resistance exceeds 5 ohms.

Alpha Corp, 65 Harvard Ave, Stamford, Conn. has molybdenum disulfide powder for **lubrication,** having average particle size less than one micron.

Master Mechanic Mfg. Co, Burlington, Wis. has Power-Slave 2.5 and 6 hp portable **gasoline motors** with interchangeable units: ac generator, water pump, and air compressor for tools or sprayers.

General Electric Co, 1 River Rd, Schenectady, N. Y. has : **Ac welders** rated 300, 400, 500 amp; models 6WK30L, 6WK40L, 6WK50L; 220/440 or 550 v, designed for low maintenance; described in Bulletin GEC-1259 . . . **Machine tool transformers** in 16 basic designs offer 100 combinations of frequency, voltage, physical arrangement; save panel space by incorporating accessory connections and protection; 50, 75, 150, 300, 500, 750, 1,000, and 1,500 va; 230/460 to 115 v, 60 cps; or 50/60 cps, 230/460/575 to 115/95 v .

Steri-Spray Corp, Great Neck, L. I., N. Y., has **spray antiseptic** for sterilizing wounds without touching them. Benzalkonium chloride is in 3½-oz. polyethylene spray container.

Correction, please

The Burndy Type Y35 Hydraulic Hypress (Nov. 15, page 196) has conductor ranges on Crimpit service tap and entrance connectors of 6 AWG to 397.5 Mcm on aluminum, 6 to 336.4 on ACSR. The higher range was given incorrectly as 447 Mcm. by the manufacturer.

Get your copy of "HOT STICKS"

a new HOT LINE tool manual

HOT off the press!

Here's the manual that linemen all over the country have been asking for. It's the most comprehensive, most authoritative guide to safe high voltage line maintenance ever published!

"Hot Sticks" has been years in the making—compiled by experts who *really know* hot line work. It contains 162 pages of detailed explanations—in a lineman's language—and has hundreds of how-to-do-it drawings and step-by-step diagrams that show every important operation.

Supply your live line maintenance crews with this valuable aid to safety. Price is $2.50 a copy. Use the coupon below to place your order.

A. B. CHANCE COMPANY • 210 N. ALLEN ST. • CENTRALIA, MO.

Please send us_____copies of "Hot Sticks" priced at $2.50 a copy.

Our check for $_____is enclosed. Bill us for_____copies.

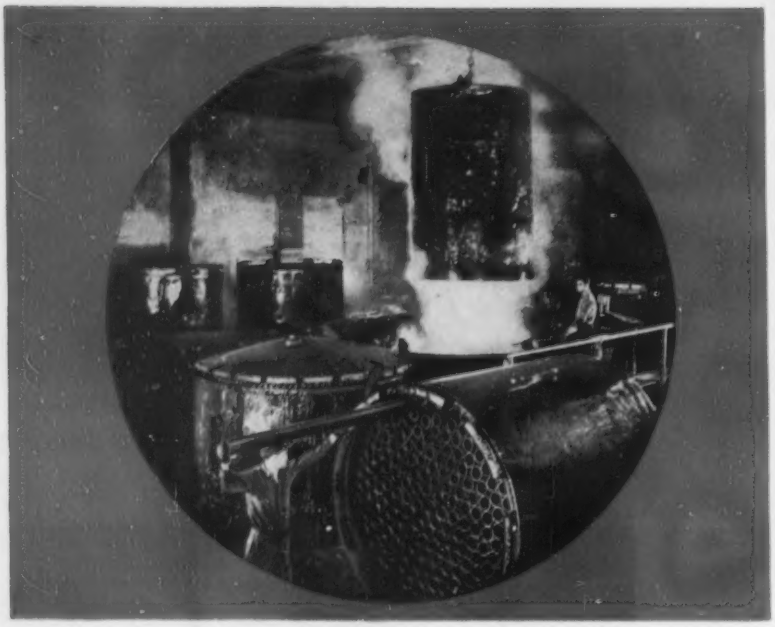
Name & Title_____

Company_____

Address_____

City_____State_____

CH54-25



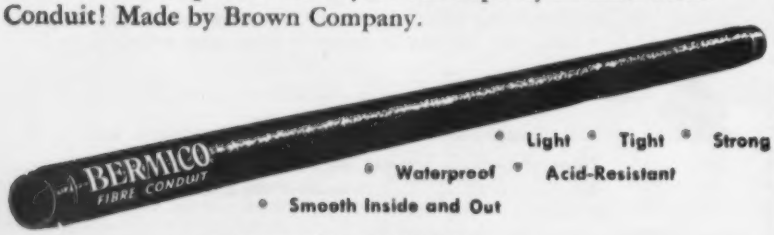
"Blending"

BERMICO® FIBRE CONDUIT

. . . for perfect uniformity Here, in the impregnation phase of Bermico's production, wood fibre and coal tar pitch become as *one* substance. Under vacuum, sturdy wood fibre tubes are thoroughly infused with tough preservative. The result is Bermico Fibre Conduit—*completely uniform* from end to end!

Bermico's uniform impregnation is matched by: *uniform wall thickness . . . uniform diameter of bore . . . uniform quality of fibre.* This pattern of uniformity is the result of production that features automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections.

For the best protection for your cable specify Bermico Fibre Conduit! Made by Brown Company.



Distributed by WESTINGHOUSE Electric Supply Company.
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

CATALOGS • BULLETINS

● **LINE TOOLS:** Catalog 7, 28 pages, is a good, illustrated coverage of hot line tools with examples of their use. Safety Live Line Tool Co, 1420 Sixth Ave, Oakland 6, Calif.

● **WORKER BOOM:** A 6-page folder, T7/54, gives specifications on 2-man, hydraulically operated boom for overhead work, the Hydro Sky-Worker. Maxwell Equipment Co, Ford St, Milford, Conn.

● **RAIN GEAR:** Catalog D2 covers rain suits, hats, and boots. John E. Dorsey Co, Boston 27, Mass.

● **LINE EQUIPMENT:** Price discount list No. 54 effective October 1, 1954, is issued by G&W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

● **ALUMINUM CABLE FITTINGS:** Looseleaf catalog (about 24 pages) gives specifications and prices on strain clamps, suspension clamps, straight dead-end clamps, loop dead-end clamps, connectors. Bethea Company, Inc, P O Box 1407, Birmingham, Ala.

● **CONNECTORS:** Jasper Blackburn Corp, 35 Madison St, St. Louis 6, Mo., offers the following condensed catalogs and consumers price sheets dated Oct. 5: Aluminum-to-aluminum fittings, 12 pages; Copper-to-aluminum fittings, 1 page.

● **TENSION SPLICES:** An 8-page bulletin, Form 2M-1054-S, gives design and performance characteristic, installing instructions, and suggestions relating to automatic-type tension splices. Fully illustrated, it also gives correct method for salvaging used splices. Reliable Electric Co, 3145 Carroll Ave, Chicago 12, Ill.

● **FUSE LINKS:** Fuse links for distribution system protection and co-ordination requirements are covered in Catalog Section 3 (8-54), 16 pages. James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

● **LIGHTNING ARRESTERS:** Catalog LA2 (8-54) covers Type E valve-type distribution lightning arrester, 1 to 15 kv (16 pages). LA3 covers PF3 expulsion-type distribution arresters, 3 to 18 kv (8 pages). LA4 (4-54) covers Type DL arrester for transmission and distribution equipment, 20 to 73 kv (12 pages). LA5 covers secondary arresters and protective gaps (4 pages). Line Material Co, Milwaukee 1, Wis.

● **SOLDERSEALED POTHEADS:** An 18-page catalog, C-79-1330, covers soldersealed potheads with a description of the sealing process, construction, installation, and tables on dimensions and sizes, 15,000 to 46,000 v. Anaconda Wire & Cable Co, 25 Broadway, New York 4, N. Y.

● **TRANSFORMERS, RECLOSERS, REGULATORS:** Catalog DT2 (5-54) covers single-phase distribution transformers, 3 to 500 kva (28 pages). DT7 (8-54) covers dry-type, single-phase transformers, 1½ to 50 kva, 600 v and lower (4 pages). RV1 (7-54) covers type RSA single-phase, 4-step voltage regulator for fringe and rural areas, 15 or 25 amp, 2½% steps (12 pages). CR1 (7-54) covers distribution-class oil circuit reclosers, 14.4 kv, 50 amp, Type H and 3H (12 pages). Line Material Co, Milwaukee 1, Wis.

● **SUBWAY DISTRIBUTION TRANSFORMERS:** Bulletin 61B6333A covers subway distribution transformers, 15 to 167 kva single-phase, 15 to 150 kva three-phase, 15,000 v and below. Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

● **SIGNS:** Catalog P-7, 24 pages, covers porcelain-enamel industrial signs, including prices. Porcelain Metal Products Co, Rosslyn Rd, Carnegie, Pa.

TECHNICAL LITERATURE

FILM AND SOUNDSLIDE: LIFELINE OF THE LINEMEN—16 mm sound or 35 mm soundslide, 20 min. Produced under supervision of the Accident Prevention Committee, Edison Electric Institute, film gives instruction in care and use of linemen's equipment. Film is available on loan or purchase basis from Buckingham distributors, or directly from Buckingham Manufacturing Co, 7-9 Travis Ave, Binghamton, N. Y.

FILM: THE STORY OF LIGHT—16 or 35 mm, sound, color, 10 min. Filmed by Transfilm-Geesink using stop-motion puppet technique; music by London Symphony Orchestra. The film tells the story of man's efforts to combat darkness, from ancient times to the 75th anniversary of Edison's invention of the incandescent light. GE Film Libraries, or General Electric Co, 1 River Rd, Schenectady 5, N. Y.

LIGHTING HANDBOOK—Revised edition of Lighting Handbook (Light's Diamond Jubilee Issue), 250 pages, covers the general field of modern lighting practices. It includes a color fold-out of the electromagnetic spectrum, information on distribution curves and light measurements, a section on light sources, coefficients of utilization, maintenance factors, footcandle tables, and application illustrations. Price, $2.50. Westinghouse Lamp Division, Bloomfield, N. J.

FILM: CLEAN WATERS—color, sound. Film is part of GE's "More Power to America" Program, and is primarily concerned with the municipal sewage problem. It is intended for public showings, and in conjunction with Bulletin GEA-6096 (below). GE Sales Offices, or General Electric Co, 1 River Rd, Schenectady 5, N. Y.

CLEAN WATERS—GEA-6096, 32 pages, covers clean water, and how to get it. Referring to municipal sewage problems, it outlines a program to provide proper sewage treatment. General Electric Co, 1 River Rd, Schenectady 5, N. Y.

WATER SUPPLY—Manual of Water Supply and Equipment (80 pages) covers everything the dealer should know about installation and servicing. Complete hydraulic and mechanical data is included. Price, $1.50. National Association of Domestic and Farm Pump Mfrs, 39 So. La Salle St, Chicago 3, Ill.

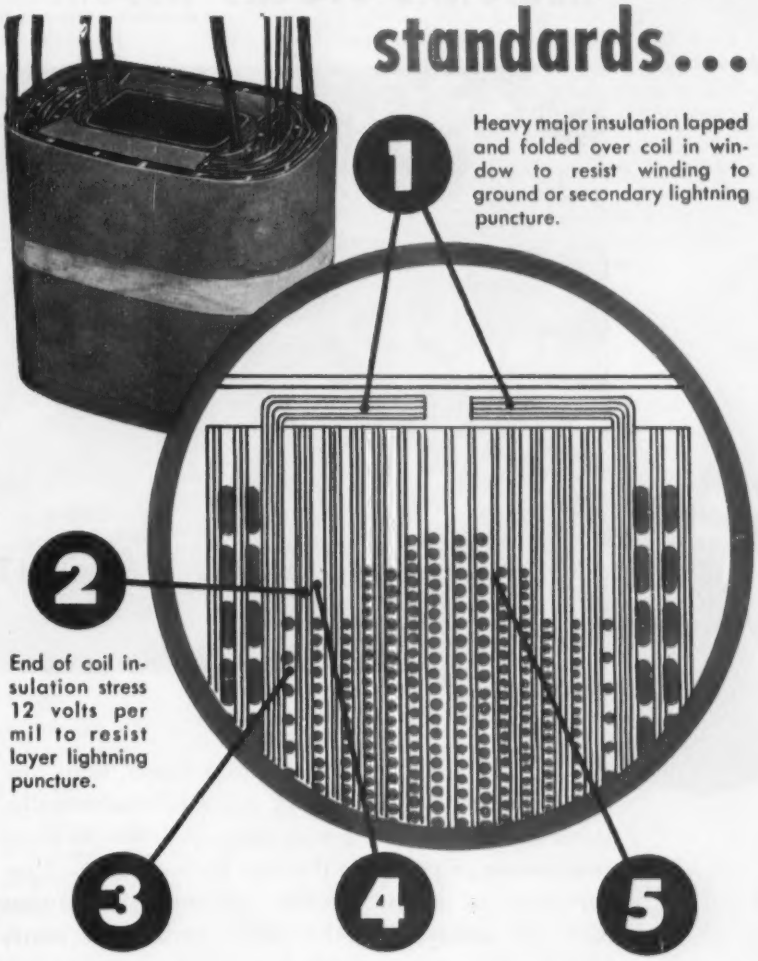
COMMUNICATIONS GLOSSARY—Microwave and Mobile Communications Terms, A Glossary (40 pages) is believed to be first formal glossary of words and definitions peculiar to the field covered. Book uses sketches, diagrams, and charts, as well as text, to define esoteric terms describing theory, nature, and operation. Many terms refer to carrier and telemetering. Dept. P-368, Engineering Products Div, Radio Corporation of America, Camden, N. J.

FILM: TOOLING UP FOR PROFITS—16 mm, color, 20 min. For showing to distributors and tool users, film compares hand-tool assembly methods with production boost made possible by electric tools in assembly of oil burners in plant of Armstrong Furnace Co, Columbus, Ohio. Thor Power Tool Co, Aurora, Ill.

WORLD POWER—Transactions of 1951 World Power Conference are available in 3 volumes at £9.15.0 from World Power Conference, 8 Gokhale Rd, Calcutta 20, India.

COOKING MANUALS—Specialized electric cooking manuals and menu makers are being packed with the Lectric Cook and Lectric Cook-all, portable electric cooking appliances. The 28-page books also contain instructions and care for the appliances. Arvin Industries, Inc, Columbus, Ind.

WHY RT&E transformers have impulse levels 150-200% NEMA standards...


1
Heavy major insulation lapped and folded over coil in window to resist winding to ground or secondary lightning puncture.
2
End of coil insulation stress 12 volts per mil to resist layer lightning puncture.
3
4
5

End layer space wound to resist turn to turn lightning failure.

End of coil layers spaced back from coil edge to resist winding to ground lightning puncture.

Center of coil insulation stress 40 volts per mil — taps located at coil centers and remote from lightning entrance points.

Impulse tests to destruction show levels of 150% to 200% of industry standards.

All R T & E coils are varnished, baked, vacuum dried and oil impregnated for insulation resistance in excess of 10,000 megohms.

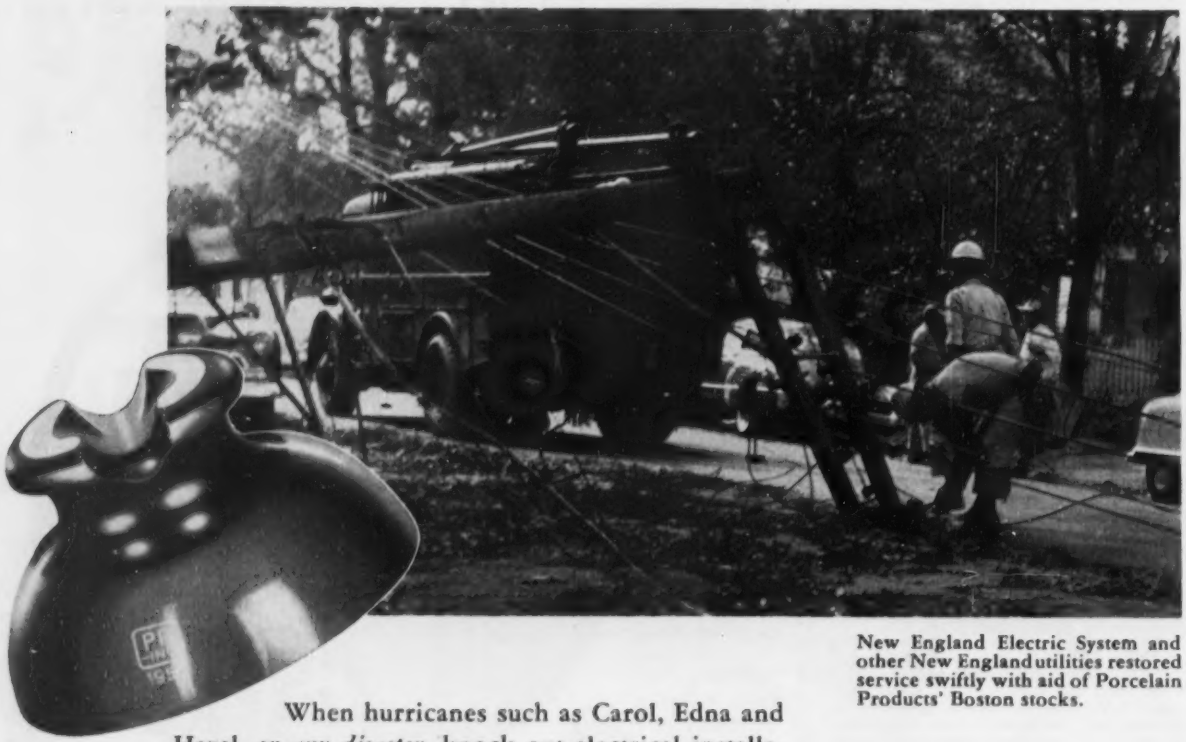
When you buy, specify R T & E

WRITE FOR CATALOG

R T & E Co.
WAUKESHA WISCONSIN

When DISASTER STRIKES

PORCELAIN PRODUCTS' STRATEGICALLY LOCATED REGIONAL STOCKS ASSURE IMMEDIATE DELIVERY



New England Electric System and other New England utilities restored service swiftly with aid of Porcelain Products' Boston stocks.

When hurricanes such as Carol, Edna and Hazel, *or any disaster,* knock out electrical installations and power over a wide area, swift and effective restoration of power is the first consideration. Procurement of vitally needed insulators and other materials must always be within immediate reach for emergency repair of damage done to power installations.

Porcelain Products' 20 strategically located regional stocks covering all sections of the United States are in complete readiness for any disaster. You, too, can depend on these 20 regional stocks to help restore electrical power in the fastest possible time.

YOUR KEY TO BETTER SERVICE

20 REGIONAL STOCKS
Coast-to-Coast
To Better Serve You

Quality you can trust

YOUR INDEPENDENT INSULATOR MANUFACTURER

60 years

Porcelain Products, Inc.

PP INC.

PARKERSBURG, WEST VIRGINIA

Export Representative: Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.

Who Ever Heard of a Wire Wearing Out?

[In this piece Mr Cooper, a registered professional engineer, is not attempting to be funny. His point is that it is foolhardy to leave house wiring, an important link in electric service, up to the inexperienced customer to plan, install, maintain, and service. His musings reflect the experience and thinking of millions of Americans whose house wiring is inadequate rather than adequate—The Editor.]

We had our house wired for electric lights in 1925. Our neighbors had 'em; so we thought we'd keep up with the times. The bill was much higher than for our old kerosene lamps, but guess it never occurred to us to go back to them.

The washing machine we got Mom gave the bankroll a jolt, but what it did for her was worth it. Plugged it in the same place she used for her electric iron, and something about another bracket kept it from changing the light bill much.

Imagine washing and ironing clothes and getting light all over the same wires. Wonder if they will ever wear out. Of course not, who ever heard of a wire wearing out.

Wouldn't it be nice if Mom didn't have to start a fire every morning and we didn't have to fill the wood box for her. Funny thing though, the salesman said we would have to put in three wires to make the new stove work. We had more than three wires in the house. But this seemed more complicated except that they explained it so simply. All they had to do was put in a combination switch and fuse box, run some new wires to the stove, pick up the old wiring with what they called a feeder, and we were back in business. Still can't figure out what sort of a job those first guys did. They musn't have known so much after all.

Of course, they deserve a little credit 'cause we didn't have to do anything when we added the toaster and coffee pot. Even when Uncle Tom plugged in the heater and put out the lights all over the house, all we had to do was put in a heavier fuse. Those guys should have put in a good heavy one in the first place. Just shows what some people will do when you trust them to do a good job.

Everything's OK now. Never believed we would have the old house lit up like this besides having an electric stove, washer, ironer, clothes dryer, radio, TV, refrigerator, home freezer, and water heater. Mom sure has it soft now. But something seems to be the matter with the lights. They look awful dim or my eyes are getting bad. Next time I pay the light bill, I'll tell 'em they ain't putting the stuff in the electricity they used to. That know-it-all neighbor of mine says we need more circuits.

Boy! Those guys down at the light company. They sent a fellow out to check. He said all we needed was a new wiring job. Said we were overloaded and our present wiring is inadequate. Some alibi, they can't kid me. They sure got us hooked. Got us used to all this stuff and "bang!" come up with a word like that. I really didn't know what he meant, but I sure wouldn't let on. Sounds like more dough to lay out on that old wiring job again. I wish I had those guys here who put it in. I'd give them a piece of my mind. Maybe it would pay to have one of those engineers lay it all out on paper first—sort of explain it and allow for those things that might come up in the future.

Oh well! I guess I'll wait awhile. Someone may come up with something, but I bet it's going to run into a lot of money. One thing's certain. We're not going to quit using the stuff we have. And it seems like they're never going to stop inventing new things that make living easier. Just hope nothing happens to that old electric blanket of mine.

Harold G. Cooper
Professional Engineer

1115 Grove St
Defiance, Ohio

'Free Ride' Gets Longer

To the Editor:

With regard to the story, "Florida P&L Gets 'Free Ride,'" which appeared on page 117 of the Sept. 20 issue, I have some additional facts. They may be of interest to your readers.

The ads to date have appeared in national magazines and leading newspapers with a combined circulation of 15,670,215—or a potential reader audience of 62 million, figured on the basis of four readers to a copy.

The cost of the advertising to the firms sponsoring it has totaled $102,042. We consider that this money was well invested because of the added appeal of the "Florida flavor" to the advertising copy.

Malcolm B. McDonald
Vice President

Florida Power & Light Co
Miami, Fla.

EW Gets All Around the World

To the Editor:

On Nov. 1 I received a postcard from Bandung, Indonesia requesting a copy of our booklet, "More Light on Your Streets". The gentleman making the request had read about the booklet in the April 12 issue of Electrical World. This just goes to show you that Electrical World really gets around.

J. Homer Shaw
Commercial Director

Business Development Dept
Utah Power & Light Co
Salt Lake City, Utah

● Despite the fact that EW charges as much as $25 a year for foreign subscriptions, foreigners are willing to pay that price to get the valuable information and many services provided by this magazine.

WALTER BOULDIN H. NEELY HENRY C. T. HUNTER

Alabama Power Names 3 VP's

Bouldin and Henry are appointed executive vice presidents. Hunter assumes Birmingham Division vice presidency

Alabama Power Co has announced a number of executive advancements and reassignments, effective Jan. 1, 1955. They have been brought about by the retirement at that time by E. W. Robinson, vice president and general manager, after 31 years' service.

The utility has also appointed a new vice president for its Birmingham Division.

New Executive VP's . . . Top level appointments include the election of two executive vice presidents. They are:

Walter Bouldin, financial vice president since 1952, will become executive vice president to whom the treasury, sales, and claims departments will report. H. Neely Henry, vice president in charge of employee relations since 1952, will become the executive vice president to whom the employee relations, land, purchasing, traffic and office buildings departments and the manager of electric operations will report.

Divisional VP . . . C. T. Hunter has been named vice president of the Birmingham Division to succeed the late Charles S. Thorn (See page 160). Hunter was advanced in 1952 from Southeastern Division vice president to vice president and division manager at Birmingham. E. S. Neighbors, assistant manager of the Birmingham Division since last September, has been appointed the division manager.

Other appointments linked to Robinson's retirement call for the assignment of R. L. Harris, manager of production since 1951, to the newly created post of manager of electric operations. Production and transmission and distribution departments will report to him. Harris' successor will be J. A. Keene, who has been superintendent of production for the past three years. The newly created post of assistant manager of production will be filled by W. W. Eberhardt, formerly supervisor of system operation.

C. T. Brasfield, Jr, who previously served as assistant to the general manager, will assume the position of executive engineer. Richard Bowron, Jr, assistant in the tax and insurance departments, was named assistant to Executive VP Bouldin.

Engineering Appointments . . . R. H. Copeland, superintendent of the Gadsden Steam Plant, will become superintendent of steam generation. W. R. Garnett, supervisor of hydro plants, will take over as superintendent of hydro generation. C. C. Jones, senior engineer-system operation, will become superintendent of system operation.

Copeland, Garnett, and Jones will report to the manager of production.

Plant Assignments . . . B. R. Wall, superintendent of Barry Steam Plant, will become superintendent of Gorgas Steam Plants. C. E. Fowler, superintendent of Chickasaw Steam Plant, will replace Wall at the Barry plant. A. Z. Robinson was advanced from assistant superintendent to superintendent of the Chickasaw plant. F. L. Clayton, assistant superintendent of Gorgas Steam Plants, will become superintendent of Gadsden Steam Plant.

A. E. Burnett, superintendent of Gorgas Steam Plants for the past six years, was promoted to the post of manager-employee relations. M. E. Wiggins, since 1952 treasurer, has new responsibilities which include supervision of the payroll, tax, and insurance departments.

•

E. A. Williams has joined Federal Pacific Electric Co as manager of its Eastern Switchgear Division headquartered at Scranton, Pa. Prior to joining the Newark, N. J., firm, Williams was associated with Railway & Industrial Engineering Co as chief engineer in charge of design, development and application of commercial and plant engineering.

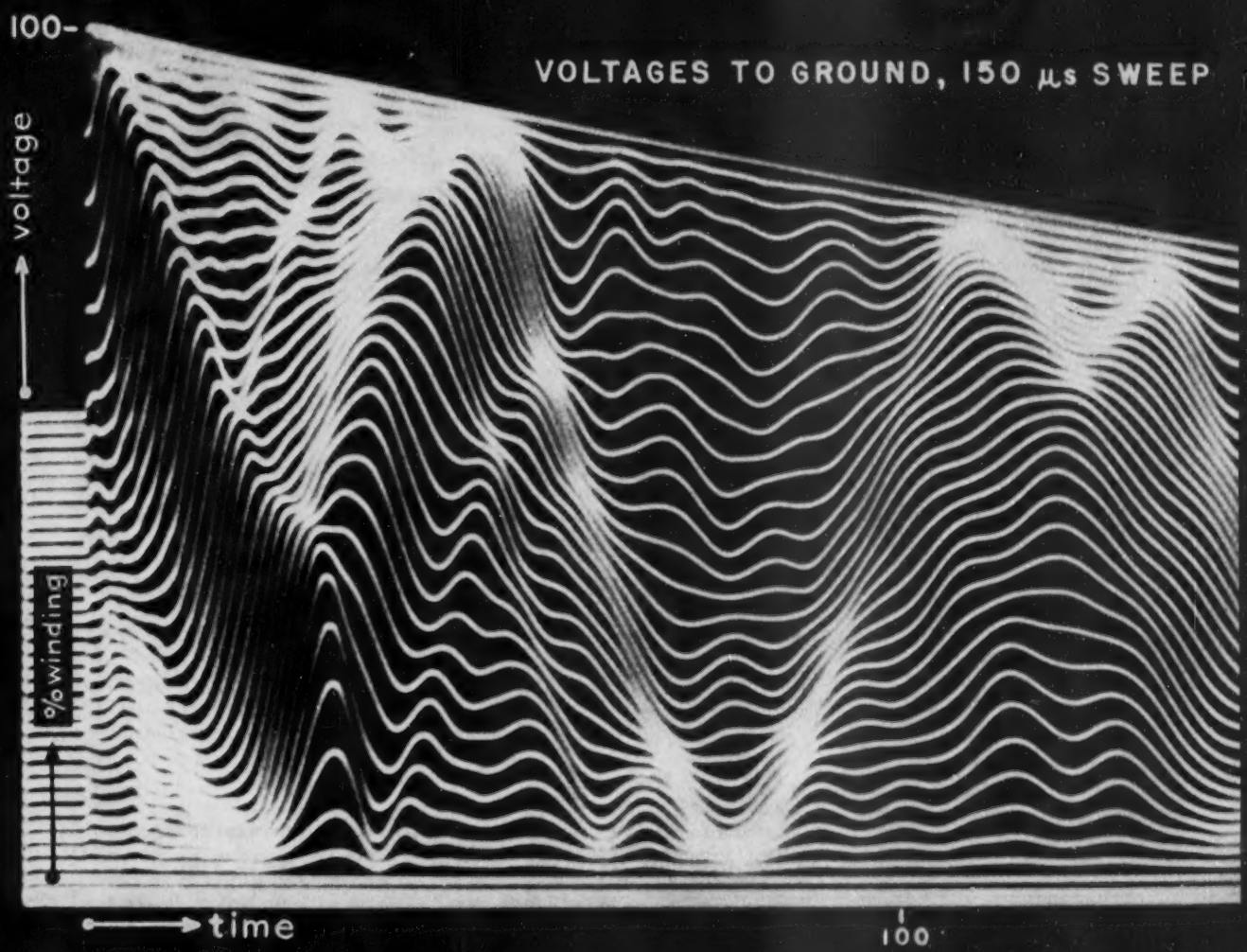
Roy P. McGalliard, formerly Coast Division superintendent of Jersey Central Power & Light Co, has been promoted to construction superintendent. **Robert H. Sims,** formerly assistant to superintendent of transmission and distribution, has been elevated to succeed McGalliard.

Melvin B. Monson, assistant manager of the Milwaukee plant of Joseph T. Ryerson & Son, Inc, since 1953, was elevated to manager of that plant. Monson, who joined the Ryerson company in 1934, succeeds **Fred Kurfess,** retired.

Russell T. Morris has been named manager of lightning arrester and cutout sales for General Electric Co's distribution transformer department at Pittsfield, Mass., to replace **Harold M. Towne,** retired. With GE since 1941, Morris has served since last January as manager of marketing, administration, and personnel development.

Franklyn Dickinson has been named head of the general sales department

(*Continued on page* 160)



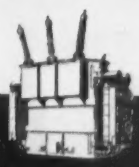
CARDIOGRAM OF A TRANSFORMER

You're looking at the heartbeat of a General Electric power transformer. This oscillogram shows the distribution of impulse voltages to ground at various points in the transformer winding . . . *before* the transformer is built.

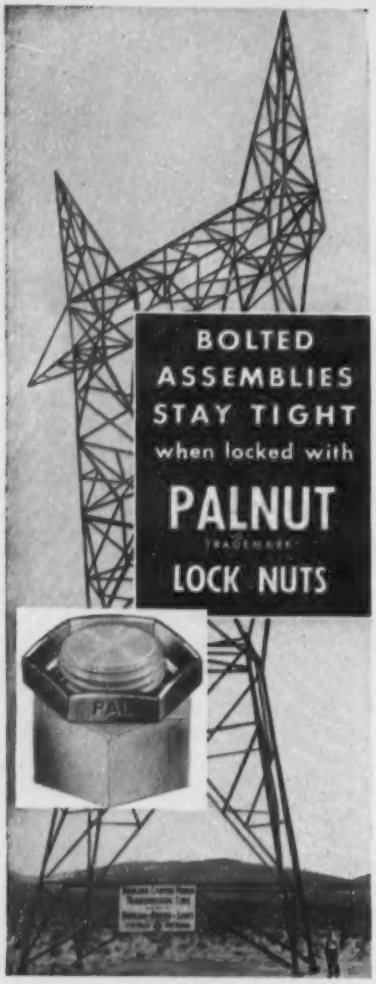
A graph like this—made automatically from an electromagnetic model in less than a minute—helps G-E designers predict the performance of the full-size transformer. "Cardiograms" are just one of the techniques G.E. uses to increase the reliability of large units and to speed up their manufacture. General Electric Company, Schenectady 5, New York. 421-23

Progress Is Our Most Important Product

GENERAL ELECTRIC



Power Transformer NEWS



Specify PALNUTS on new lines . . . add PALNUTS to existing lines, to eliminate further re-checking and re-tightening of bolts. PALNUT Locknuts are the lowest cost, most dependable method of locking steel tower bolts. Once tightened, their double locking spring action holds tight under severest vibration. PALNUTS are extremely low in cost, require only three bolt threads, apply fast, may be removed and reused. Hot Dip Galvanized and other finishes and materials used by utility industry. Free samples on request.

The PALNUT Co.
51 Cordier St.
Irvington 11,
New Jersey

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

NARUC Convention

(*Continued from page* 92)

specific governing statutory limitation, the arguments for a computed cost rate base are given relatively short shrift. If, as appears to be the case, the administrative and other difficulties presented by a computed cost rate base (i.e. fair value) base prevent a widespread conversion to this faith of those members of the regulatory bodies who are free to make an untrammeled choice, it would seem proper to suggest that the economists and accountants might more profitably bend their efforts to meet in other ways the situation presented by the existing inflation.

"Similarly, there has been a noticeable reluctance among regulatory authorities to adopt the technique of economic depreciation, which involves an allowance for depreciation costs based on replacement costs of utility plant. So far as appears, no commission has as yet permitted any such accounting treatment, and it was specifically disapproved by the North Carolina Supreme Court in the **Southern Bell Telephone** case . . . This is doubtless due to at least two major considerations. First, it is difficult to forget the commitments made by the Bell System when it originally supported straight line depreciation accrual accounting in 1931, and it is equally difficult to square this idea with the principles of the Lindheimer case as reaffirmed in the **Hope Natural Gas** case. Furthermore, until the Treasury Department permits accruals of this nature free of taxes, the commissions are naturally reluctant to compel the ratepayers to foot the bill. Whatever may be the reason, there has most certainly been no disposition to approve this particular proposal."

The Inflation Problem

"On the other hand, there has been substantial recognition given to the problems of inflation by many commissions, and various means of assisting the utilities have been adopted. The phenomenon of attrition has, for example, been noted and some relief given on account of it. By this term is meant the tendency of the rate of return to diminish gradually as plant facilities are added at current cost levels. This factor seems to have been a major consideration up to the present time only in the telephone industry, but it is demonstrably present there and there is every indication that similar claims may be made in the future by other utilities. In attempting to meet these claims, some jurisdictions have used a rate base as of the end of the period instead of an average over the period, thus giving effect to the construction program, or have incorporated into the rate base some, at least, of the plant under construction. In other states, a rate of return has been used which is higher than would otherwise be employed, the higher rate being justified by the evidence regarding attrition."

Atomic Power Committee

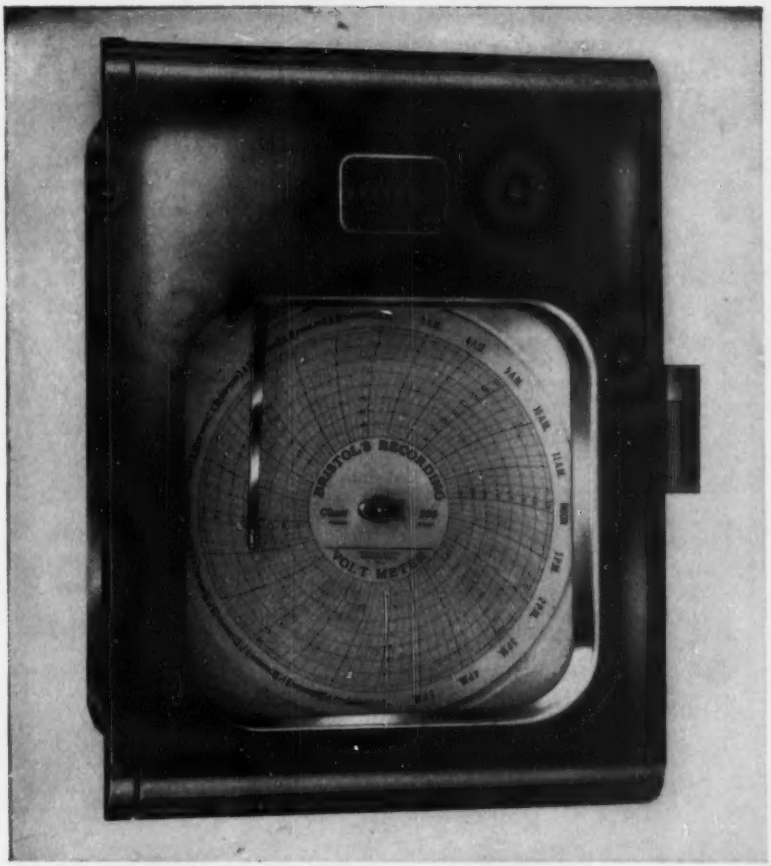
The NARUC committee report on "Development and Use of Atomic Power in the Electric Industry" pointed out that public and private power systems, representing more than 50 million kw of generating capacity and serving 50.9% of the customers in the U. S., are actively engaged in the study and development of atomic energy projects.

The convention adopted a resolution for the NARUC president to create a special seven-man committee to study the line of demarcation between federal and state jurisdictions and eliminate duplicate regulation while avoiding the creation of any gap or hiatus in regulation. The committee was authorized to draft necessary amendments to the Federal Power Act which are to be submitted to the NARUC executive committee for approval. These amendments will then be sent to the 84th Congress for consideration.

It also adopted a resolution relating to the cost of relocation of utility facilities necessitated by Federal-aid highway projects. It asked that existing discrimination against non-railroad utilities be eliminated and equal treatment be accorded all utilities having facilities involved in these highway projects.

The NARUC elected W. F. Whitney of the Wisconsin PSC president; Benjamin F. Feinberg, chairman of the New York PSC, first vice president, and Richard Mack of the Florida PUC second vice president.

The convention voted to hold its 1955 annual convention in San Francisco. No date has been set but it will be between Sept. 15 and Oct. 30, 1955.



NEW, EASY-TO-READ BRISTOL RECORDING VOLTMETERS AND AMMETERS are available for permanent mounting or for use as portable instruments.

You'll get greater accuracy, greater dependability with Bristol recording voltmeters and ammeters

Here's why:

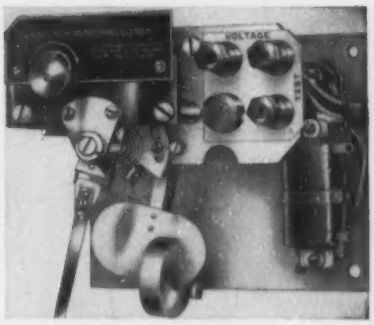
1. Low electrical burden — the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensation.
4. Shock-proof measuring mechanism mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes — up to full scale value.

These modern units are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

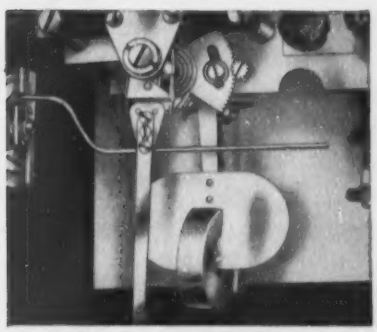
Get the whole story on these precision instruments. Write today for free 28-page Bulletin E1111 to THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Many ranges carried in stock for immediate delivery

LOOK AT THESE FEATURES!



NEW MEASURING MECHANISM — High-quality, accurate, dependable Bristol moving-iron mechanism used in all models.



MAGNETIC DAMPING — all models equipped with aluminum vane and alnico magnet damper which gives maximum speed of response possible with minimum overshoot.

PEN MOUNTING — Pen-arm mounting shaft firmly supported at both ends — eliminates trouble from back-lash and lost motion. Pen arm is readily removed and replaced.

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

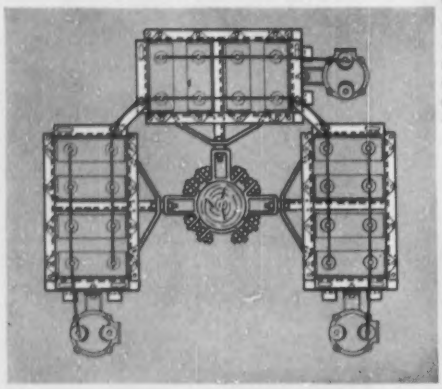
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

HANGING CAPACITORS WITH

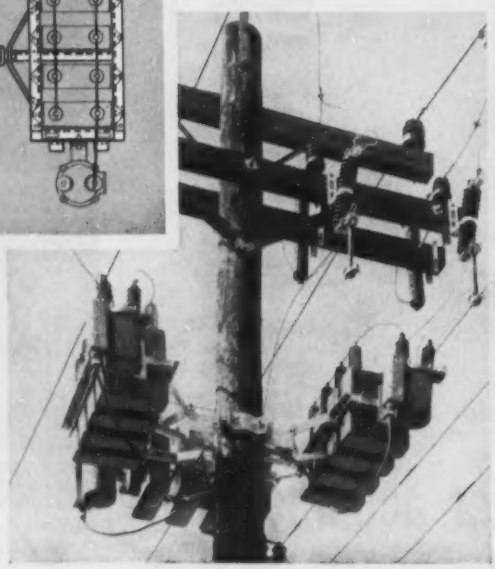
UNIVERSAL CAPACITOR RACKS

SAVES UP TO *40%*

INSTALLATION COSTS



With Universal Racks you simplify hanging capacitors . . . Actual labor time greatly reduced by ground assembly and eliminates gaining the pole—drilling holes — excessive material handling.



NO OTHER HANGING METHOD HAS ALL THESE ADVANTAGES

LOWER COST — per overall installation. Actual records prove saving up to 40% over conventional methods.

NO MAINTENANCE — All parts hot dipped galvanized to most rigid A.S.T.M. specifications. Capacitor racks will outlast pole.

LESS POLE SPACE REQUIRED — Allows multiple units to be installed on one pole. All points on top of—alongside—and under capacitors easily accessible.

BETTER WEIGHT DISTRIBUTION — Prevents buckling and/or drifting of the pole. Stronger installations.

VERSATILE — Will mount either standard distribution size capacitor groups. Universal Pole Brackets will fit any pole from 6 to 10½ inches or 9½ to 14 inches in diameter.

There are other advantages to be found in using Universal Pole Brackets and Universal Capacitor Racks. Write now for free catalogue or request us to send a representative to see you. No obligation, of course.

UNIVERSAL
POLE BRACKET CORP.
P. O. BOX 1118—HOUSTON 1, TEXAS

News About People

(*Continued from page* 156)

of Ohio Edison Co. He replaces **C. L. Dunn,** who has retired after 43 years' service with Edison and predecessor companies. Dickinson's successor as general supervisor of industrial development is **Walter T. Ackley,** general supervisor of dealer co-ordination activities.

OBITUARY

Charles S. Thorn

Charles S. Thorn, vice president of the Birmingham Division of Alabama Power Co, died Nov. 9 at Birmingham.

After spending a number of years in construction and operation of electrical utilities in various states, Thorn went to Birmingham in 1927 as supervisor of engineering of the former Birmingham Electric Co. Then he served successively as chief engineer, assistant to the president, vice president and general manager, president, and a director of the company. When Birmingham Electric and Alabama Power were merged in 1952, Thorn was president of the former, a post which he had held since 1947.

Born in Washington, D. C., Thorn received an electrical engineering degree from Rensselaer Polytechnic Institute, Troy, N. Y. He was a member of American Institute of Electrical Engineers and also a past director of the Southeastern Electric Exchange.

STRONGER THAN THE PIN

In laboratory tests to determine the torsion strength of Kimble *Tempered* Glass Insulators, wood pins were sheared off, and lead-bushed threads stripped, with no failure of the Insulators. Cantilever tests using special alloy pins were discontinued at 10,000 lbs. with still no failure. Ultimate impact tests averaged 130 inch pounds!

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen for lineup with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-11, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

IN THE FIELD as in laboratory tests . . . *Crapo* Galvanized Steel Strand proves itself capable of withstanding severe punishment. Steel's inherent strength and durability are combined with definite economies in every size and grade of *Crapo* Steel Strand. You'll find the heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

PRESSITE
an unsized fibreboard having excellent dielectric, physical and chemical properties. Is used principally in air, oil and askarel transformers.

ELECTRITE
a high grade board for electrical insulation, possessing high tensile and dielectric strength. Used in a large variety of punchings and other insulating applications.

DENSITE
an extremely hard and tough board of superior quality. Used by many leading manufacturers of electrical equipment to replace more expensive types of insulating materials.

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BOOKS

Received Since November 1.

Prufung der Elektrizitatszahler, Mabeinrichtungen, Mebmethoden und Schaltunger, Vierte verbesserte and erweiterte Auflage. By Dr. Ing. Karl Schmiedel. Published by Springer-Verlag, Berlin W 35, Germany. 234 pages. (in German).

Ultra High Frequency Propagation. By Henry R. Reed and Carl M. Russell. Published by John Wiley & Sons, Inc. New York 16, N. Y. 562 pages, illustrated. Price $9.50.

Water Conditioning for Industry. By Sheppard T. Powell. Published by McGraw-Hill Book Co, New York 36, N. Y. 548 pages, illustrated. Price $9.0?

Modern Physics for the Engineer. By Louis N. Ridenour. Published by McGraw-Hill Book Co, New York 36, N. Y. 499 pages, illustrated. Price $7.50.

Electric System Operation. By B. G. A. Skrotzki. Published by McGraw-Hill Book Co, New York 36, N. Y. 370 pages, illustrated. Price $6.50.

Electrical Elements of Power Transmission Lines. By H. B. Dwight. Published by Macmillan Company, New York 11, N. Y. 188 pages, illustrated. Price $4.25.

National Fire Codes-Vol. V-Electrical. Published by National Fire Protection Association, International, Boston 10, Mass. illustrated.

Abbott's National Electrical Code Handbook. By Charles L. Smith. Published by McGrawHill Book Co, New York 36, N. Y. 642 pages, illustrated. Price $7.50.

Lamps for a Brighter America. By Paul W. Keating. Published by McGraw-Hill Book Co, New York 36, N. Y. 246 pages, illustrated. Price $4.00.

Einfuhrung in die Hochspannungstechnik. By von Dr. Max Wellauer. Published by Verlag Birkhauser, Basel Stuttgard, Elisabethenstrasse 15, Switzerland. 331 pages, illustrated. (in German).

Nuclear Physics

The Microphysical World. By William Wilson. Published by the Philosophical Library, New York. 216 pages, illustrated. Price $3.75

It is possible to derive here the historical path of our knowledge of molecular structure from the days of Dalton. The British author relates each forward step to the preceding so that spectra, x-rays, radiant heat and the quantum theory fall into a pattern. The effort is made to reconcile the corpuscular with the undular theory of light. Closure takes place inside the nucleus of the atom.

Lighting

Lighting for Color and Form. **By Rolla Gillespie Williams. Published by Pitman Publishing Corp, New York 36, N. Y. 340 pages, illustrated. Price $8.50.**

This book combines scientific facts concerning light and color with psychological and dramatic values and brings together several branches of knowledge covering lighting principles and practices. It includes the latest information on additive color blending and the important characteristics and details of light sources and filters useful in the field of applied color and directional lighting. It also has practical applications covering display, architectural, photographic, motion picture and television studio, stage, exterior and photochemical lighting. Architects, scientists, designers, engineers, artists and contractors should find this book helpful in their lighting projects.

Gear Design

Gears for Small Mechanisms. **By W. O. Davis. Published by N.A.G. Press Ltd., London. Distributed by Henry Paulson and Co, Chicago. 157 pages, illustrated. Price $5.00.**

A reference book that concerns itself primarily with the kinematics of design of gears and tools for cutting and generating gear tooth forms. This is primarily a book for gear designers and gear manufacturers.

Analog Computation

Analog Methods in Computation and Simulation. **By Walter W. Soroka. Published by McGraw-Hill Book Co, Inc, New York 36, N. Y. 390 pages, illustrated. Price $7.50.**

The growing complexity of engineering problems has brought automatic high-speed, high-capacity digital computing machines into increasing use to provide analytical solutions that are either too costly or time consuming to secure by other means. Out of this situation has grown a need for an organized treatment of the methods of analog computation.

This text and reference by Professor Soroka of the University of California fills this need admirably. He has organized, classified and presented a wide range of material on analog computation. The book describes mechanical, electro-mechanical, electrical and electronic analog components for performing basic mathematical operations and then shows how such components may be combined into mathematical machines for solving sets of simultaneous linear algebraic equation, polynomical equations and differential equations of all kinds.

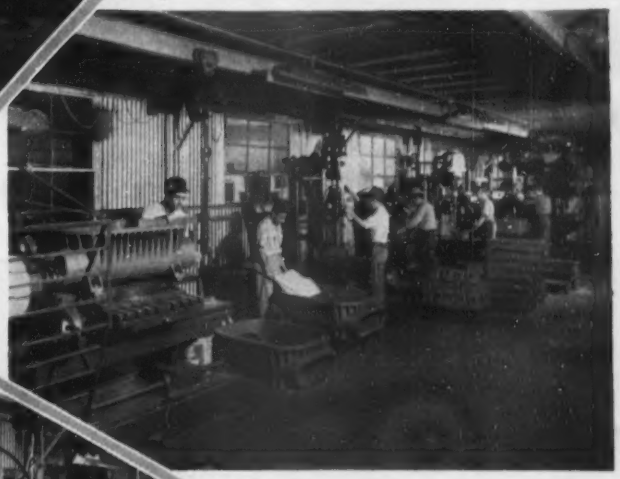
Closing chapters develop the dynamical similarity between electrical circuits and mechanical systems and use it as the basis for representing mechanical systems in lumped form by equivalent circuits with lumped parameters. Also ordinary and partial differential equations of various degrees of complexity—linear and non-linear—are expressed in finite differences and electrical networks developed for their solution.

Visit OUR FACTORY!

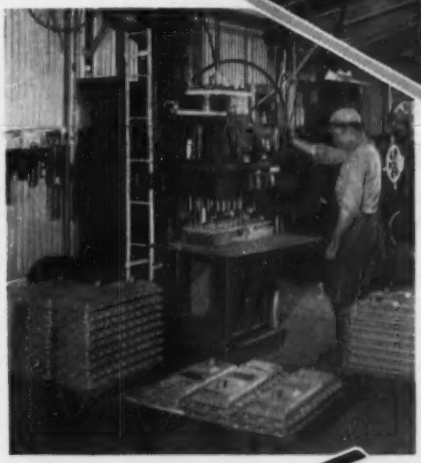
. . . see explosion-proof castings being processed in the NELSON "Box" Shop . . . . .

AMPLE STOCKS OF RAW CASTINGS: Enclosures for Nelson explosion-proof circuit breakers, motor starters and junction boxes are shown in storage yard awaiting machining. All castings are produced in the Nelson Foundry.

ALL FLANGE SURFACES RECEIVE TWO GRINDING OPERATIONS: Flanges and mounting feet of Nelson cast iron enclosures are given a rough-grind followed by a finish-grind, thus insuring a close tolerance and a smooth, machined surface.



DRILLING COVERS FOR MOTOR STARTERS: Photograph at right shows multiple spindle drill being used to drill covers for Nelson explosion-proof combination motor starters.



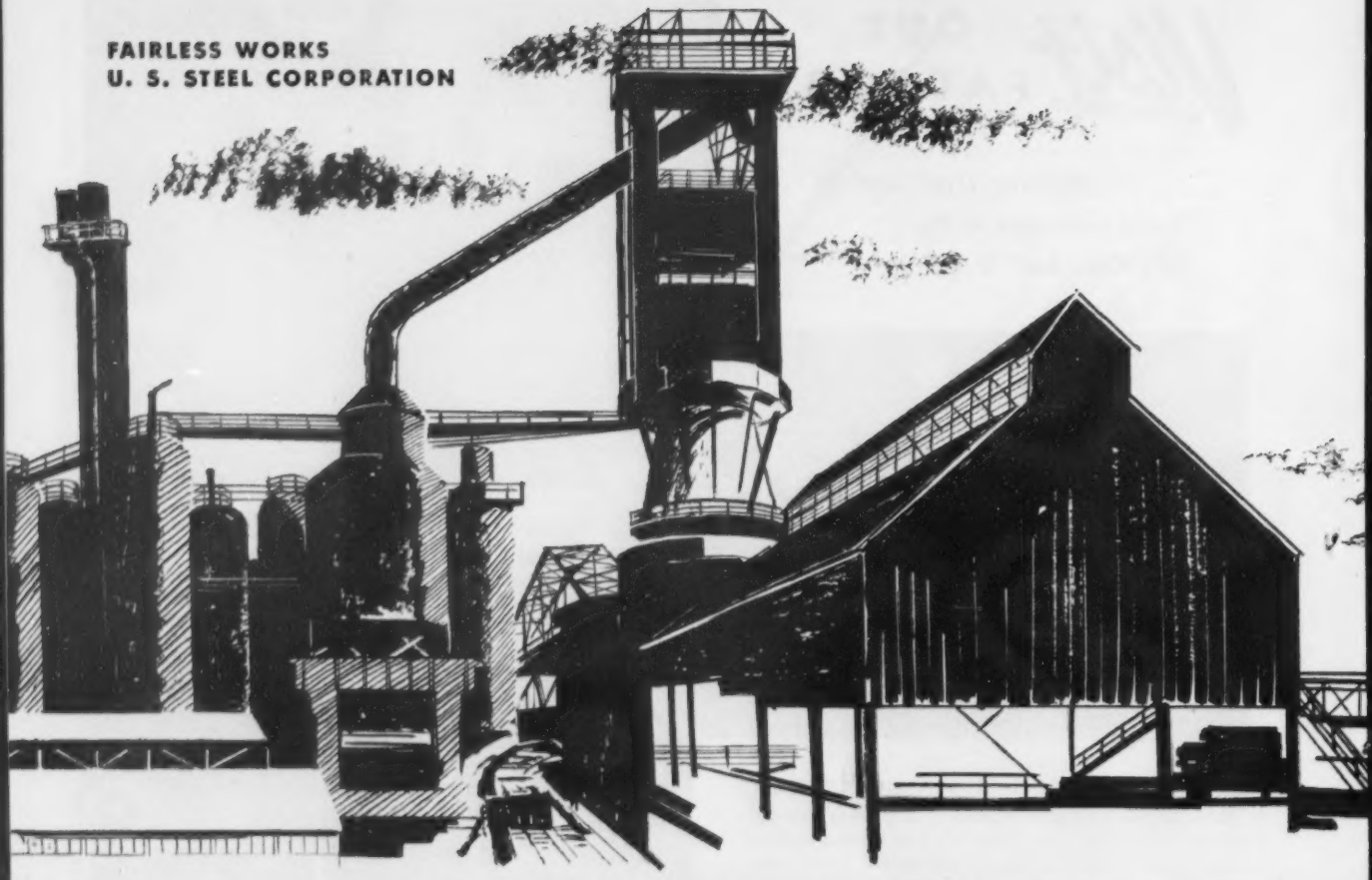
DRILLING CONDUIT OPENINGS AND MOUNTING FEET: Above photo shows the area of the Nelson Box Shop where conduit openings for breakers, starters, junction boxes and lighting panels are drilled and tapped; and where holes for flange bolts, mounting feet and mounting pans are drilled. Boxes are made ready for installation of controls and electrical assemblies.

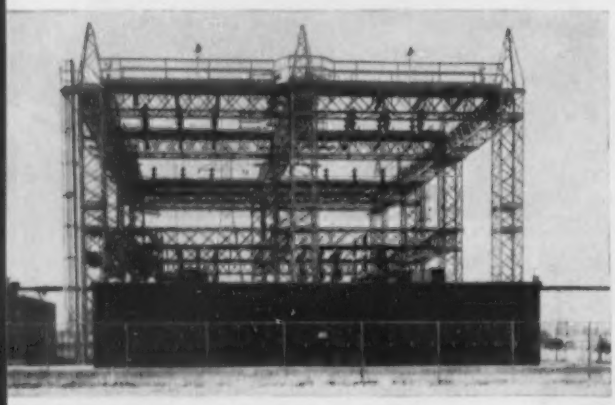
No. 4 in a series of pictorial tours through the Nelson Plant showing Nelson Electrical Equipment "in the making".

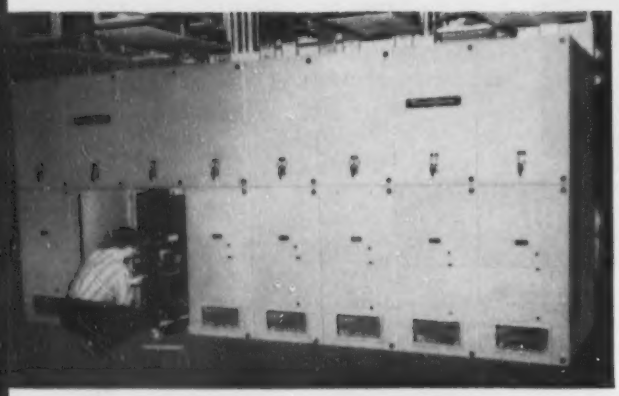
NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

MANUFACTURERS OF:
Motor Starters • Circuit Breakers • Lighting Panels and Junction Boxes in water-tight, dust-tight and explosion-proof enclosures • Instrument and Control Panels • Switchgear and Unit Substations • "Centrol" Motor Control Centers • "Nelex" Mineral Insulated Heater Units

FAIRLESS WORKS
U. S. STEEL CORPORATION







(*Top Left*) This substation is typical of the five servicing the mill, pump house, power house and power company incoming line areas.

(*Bottom Left*) D-C power distribution to the hot and cold mills, the open hearth, blast furnace, and coke plant areas is handled through Westinghouse low-voltage metal-enclosed switchgear.

(*Top Right*) Duplex control switchboards are used for local control, protection and metering of primary substations. Supervisory control relays are included to provide for normal unattended operation.

Matching modern power system design and apparatus to a new, completely integrated steel mill

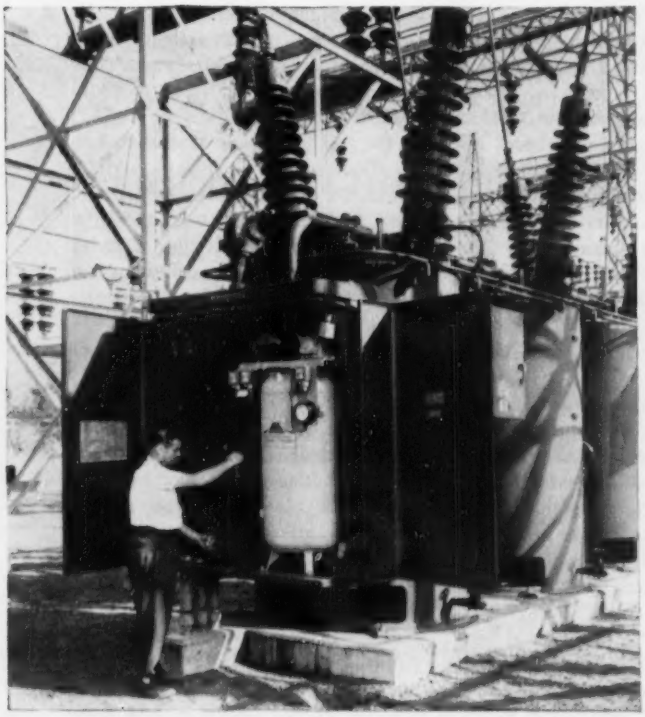
To the steel industry, Fairless Works was a "once-in-a-lifetime" opportunity: to apply—in one place—*every* technical advance in steelmaking.

The power system was no exception. With the valuable aid of Westinghouse application experience and AC Calculating Board studies, U. S. Steel engineers chose a 69-kv dual primary distribution system to all five Westinghouse-designed and manufactured substations. Secondary 13.8-kv distribution continues through Westinghouse metal-clad switchgear with Type DH, 500,000-kva air circuit breakers.

Then they matched this modern system with equally modern apparatus—much of it Westinghouse. Why Westinghouse? Because the advanced design and proved dependability of Westinghouse switchgear apparatus offered the best opportunity to provide maximum service continuity to Fairless Works—with minimum installation and maintenance expense.

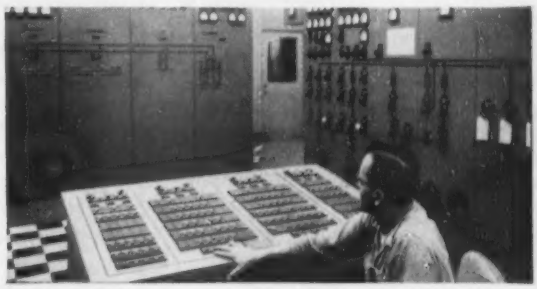
Isn't there an idea here for you—if you're thinking about building a new plant or updating an old one? Just call your Westinghouse representative. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60872

YOU CAN BE SURE...IF IT'S Westinghouse



Three Westinghouse Type GM-5, 5000-mva circuit breakers are used for switching the 132-kv power company tie circuits. The 69-kv circuits employ fourteen Type GO-4B, 1500-mva circuit breakers.

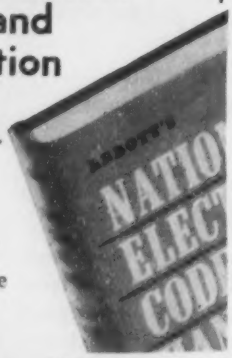
This hot strip mill metal-clad assembly is typical of the indoor equipment used for the slabbing, blooming, billet and bar mills. A total of 200 Type DH, 500,000-kva metal-clad units are in service.



Westinghouse supervisory control concentrates operation of the distribution system for the entire works on a single desk. This centralized control provides for rapid and most efficient power distribution at all times.

How to handle wiring and installation jobs...

in strict accordance with the 1953 National Electrical Code



Just Out

Eighth Edition

Abbott's

NATIONAL ELECTRICAL CODE HANDBOOK

Revised by CHARLES L. SMITH

Electrical Field Engineer of the National Fire Protection Association

GREATEST IMPROVEMENT IN 20 YEARS!

642 pages, 5½x8, 394 illus., $7.50

NO need to waste time puzzling over National Electrical Code rules! You can get their EXACT meaning—how they apply to the job you're doing—quickly and easily with this practical handbook. Explains the rules in simple, clear language — and uses diagrams, tables, and photographs to make sure you grasp every essential point.

This Eighth Edition is completely revised—a brand new style that presents the meaning of a rule in a contrasting typeface to the rule itself—thus making for quicker and easier reading. And Code rules are given in exactly the same sequence as in the Code itself!

- New form and typesetting make book easier to use.
- Now arranged in same order as Code
- Meanings of rules stand out in contrasting typeface

The book includes all changes and additions of the 1953 National Electrical Code. A handy index lists Code rules applying to all types of electrical jobs, arranged under job title. Thus, you can be sure no rule is overlooked.

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Cubatao Cable

(Continued from page 79)

quirements, stipulate that a supply of oil sufficient to fill one pipe be always available and provision be made for storage of the oil drained from one pipe.

The equipment will include an oil operating and storage tank in which dried and degasified oil is kept under a slight positive pressure of inert gas (nitrogen). A duel pumping plant, with the requisite pressure switches and relief valves, will maintain the necessary oil pressure in the cable pipes through a manifold and flexible connections with the appropriate valves. A flexible connection may be attached to the drain valve of any pipe to drain oil into discharge tanks. Multiple tanks will make the best use of the limited space.

The storage tank will be filled with treated oil. To fill a cable pipe, vacuum pumps will be attached to the spreader heads at both ends, and oil will be pumped from the tank into the pipes by an auxiliary high-capacity pump inserted in the bypass of the pumping plant. When the oil reaches the switchyard spreader head, the pumping plant will be cut in, the riser pipes and potheads filled, and the whole system brought up to pressure.

To drain a pipe, the flexible connection from the discharge tanks will be connected to the drainage valve on the pipe and the inlet valve will be closed. The pipe will be vented at the spreader heads, and the oil will run into the discharge tanks. This oil can be reclaimed and returned to the storage tank.

Oil supply components have been placed with due regard to the space unoccupied by other equipment in the power cavern. A very satisfactory layout has been obtained by placing the storage tank on a mezzanine floor at elevation 25.62 meters (84.05 ft), the pumping plant and control panel at elevation 20.26 meters (66.47 ft), the manifold in the cable tunnel at elevation 15.8 meters (50.84 ft), and the discharge tanks at elevation 10.6 meters (34.78 ft). This arrangement makes it possible to flush and fill all auxiliary piping by gravity.

POWER BRIEFS FROM THE NEWS

● Utah Power & Light Co is testing its new $10.5-million, 66,000-kw steam plant at Castle Gate, Utah. The facility, located at mouth of a coal mine owned by Independent Coal & Coke Co, will go on permanent operating basis early in December.

● Plans for a proposed $20-million electric construction and development program are being considered by Central Illinois Light Co. The program, which would cover a three-year period, would include new generating capacity, substations and transmission lines.

● After 22 years of planning and controversy work has gotten under way on the 33,000-kw Pilot Knob generating plant of Imperial (Calif.) Irrigation District. Groundbreaking ceremonies were held early in November on the $10-million project on the All American canal six miles southwest of Yuma, Ariz.

● A preparatory power test was run early this month as a forerunner for permanent interconnection between two power pools. For a 48-hour test period beginning at 12:01 Friday morning, Nov. 12, and continuing to midnight Saturday, Nov. 13, Otter Tail Power Co's system was interconnected with utilities whose combined systems extend from the Missouri River on the west to Indiana on the east, and from Canadian border south into Iowa, Illinois and Indiana. This created a power pool of 3-million kw. At the same time Otter Tail was linked with the Chicago power pool, including companies of eastern Wisconsin, Illinois and Indiana.

● Central Vermont Public Service Corp plans to start construction early next year on a new general office building to be located about one-quarter mile north of its present general office in Rutland. The new building, which will also house the general operating and engineering offices, is estimated to cost about $700,000. The two-story structure is slated for occupancy in 1956.

● Public Service Co of Oklahoma will spend $40 million for expansion and modernization program of its Tulsa steam generating station by increasing capacity by 400,00 kw.

(More News on page 170)

This booklet tells how . . .

This 32-page booklet can help you build or repair apparatus, to operate better at lower cost. Gives properties and advantages, test data, construction drawings, case histories, application details. Also describes the board products and composites.

Quinterra® and *Quinorgo*® Electrical Insulations lengthen service life...simplify production...cut costs

Quinterra is the pyrolysis-resistant dielectric that helps cut electrical apparatus costs. More and more manufacturers are using it to make apparatus smaller and safer, at lower cost. Its composites are being used in Class "B" and Class "H" motor rewinding. It permits equipment to operate at higher temperatures because it remains a dielectric despite heat and time . . . the bulk of its dielectric strength is in the purified asbestos base sheet. Its mechanical strengths, thinness and flexibility permit economical application.

Quinorgo is the moderate priced, high temperature insulation for use alone or in composites. Designed for operating temperatures up to 130C, it combines high dielectric and mechanical strengths. High in absorption capacity, it can be readily treated and combined with other dielectrics. Furnished only in untreated form.

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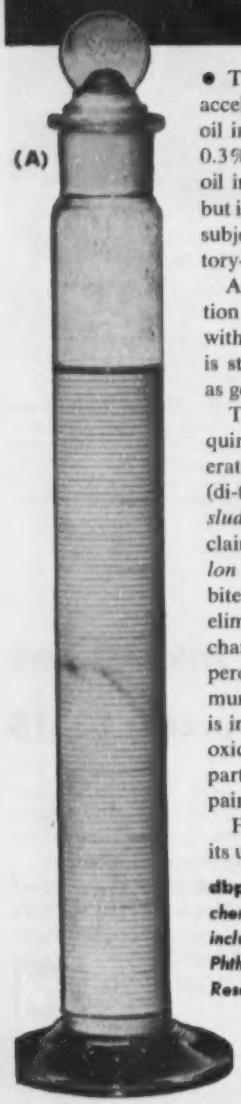
Accelerated Oxidation Tests Prove—

dbpc®-inhibited oil stays sludge-free

(A)



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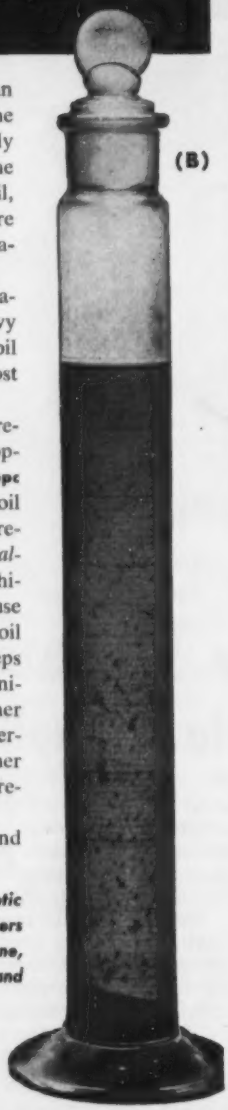

• These vials show the results of an accelerated test on transformer oil. The oil in vial "A" was inhibited with only 0.3% by weight **dbpc** antioxidant. The oil in vial "B" is the same type of oil, but is uninhibited. Both vials of oil were subjected to the same number of laboratory-simulated "years of oxidation."

After 50 days of accelerated oxidation tests, the uninhibited oil is heavy with sludge, while the **dbpc**-inhibited oil is still completely sludge-free—almost as good as new.

Today's high-load transformers require a sludge-free insulating oil to operate efficiently and economically. **dbpc** (di-tert-butyl-para-cresol) keeps this oil *sludge-free,* whether it be new or reclaimed *for as little as two-cents per gallon material cost!* And because inhibited oil lasts so much longer, its use eliminates the expense of frequent oil changes. Moreover, since **dbpc** keeps peroxide and acid formation to a minimum, the service life of the transformer is increased. Without an inhibitor, peroxides and acids attack the transformer parts necessitating frequent costly repairs.

For further information on **dbpc** and its uses write to Koppers today.

dbpc is only one of the many synthetic chemicals produced by Koppers. Others include Styrene Monomer, Polystyrene, Phthalic Anhydride, Divinylbenzene and Resorcinol.

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480Y/277

(*Continued from page* 85)

savings. Before the most advantageous voltage can be selected for this building, all components must be studied in more detail.

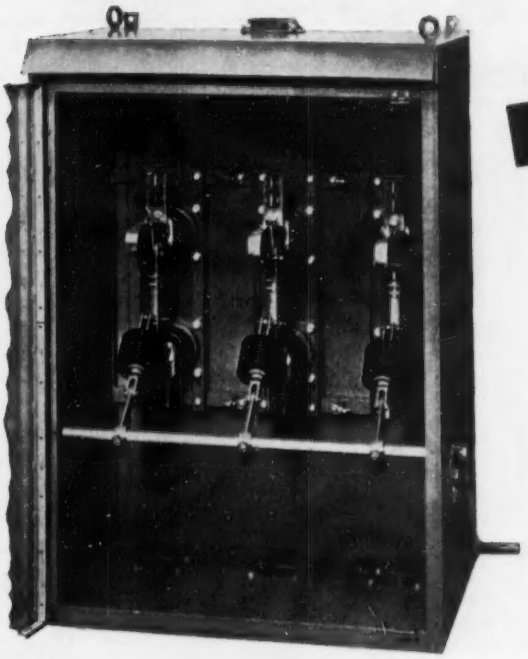
If such a building had no appreciable load that could be supplied at 480 or 277 v, the transformer cost would be approximately $22 per kva and the main substation savings approximately $7 per kva. Hence the feeder must contribute at least $15 per kva to make the higher voltage economical. When average feeder lengths exceed 250 ft, 480Y/277 v should still be considered.

Network Exigencies . . . A utility's own economics may preclude the use of the higher voltage in a building in a secondary-network area. The higher voltage would involve duplication of existing facilities or expansion of spare parts to cover a new group of equipment. The lower voltage may be desirable for strengthening an overloaded network.

Some utilities have placed limits on kva demand for 480Y/277-v network service. Appreciable savings in entrance switchgear, according to Fig 2, do not occur until demand is between 1,000 and 2,000 kva. Buildings in a network area do not show appreciable savings at the higher voltage until demand exceeds this 1,000-to-2,000-kva range, except when feeders are very long. If 480Y/277 v can be made available for such a building and a third to a half of the load can be supplied directly, the higher voltage should produce a saving. When less than a third of the load can be served at 480Y/277 v, average feeder length must be longer than 300 ft to justify the higher voltage.

Locations Outside Network Areas . . . For buildings outside the secondary network areas, savings on entrance switchgear more nearly approximate those in Fig 1, the utility usually supplying the load from an isolated transformer bank. Such a building must have a load sufficient to justify 3-phase service. When 3-phase service is supplied, the same factors govern the economy of using the higher voltage: One third to one half the load supplied by 480 or 277 v or average feeder length at least 200 to 300 ft in the building.

High Voltage Current Interruption Without External Arcing



3.P.S.T. 400 ampere 15KV metal enclosed Air Interrupter Switch. Enclosure door open, insulating barriers not shown.

CHECK THESE 3E FEATURES

SAFETY . . . All metal enclosure designed in accordance with the best engineering and manufacturing practices. For additional safety, positive interlocks, with doors and related equipment are available.

ACCESSIBILITY . . . These compact 3E Switches provide easier inspection, maintenance and adjustment in a normal amount of space.

ECONOMY . . . There are many conditions under which 3E Air Interrupter Switches when combined with power fuses can spell real economy. Switches are used for load interruption and fuses for short circuit protection . . . doing away with more expensive circuit interrupting equipment.

3E Air Interrupter Switches will safely interrupt loads up to 600 amperes at 15KV. They provide a visible gap for isolation of apparatus, and use self-generated gas blasts to extinguish the fully confined arc. No oil or other inflammable liquids are used.

Consult your nearest 3E representative or write us for information as to how the 3E Interrupter Switch can be applied to your switchgear requirements.

ELECTRICAL ENGINEERS EQUIPMENT CO.

3E AIR INTERRUPTER SWITCHES

MELROSE PARK, ILLINOIS

Fold up your derrick from inside the cab!

with the

TEL-E-LECT STORAGE KIT

The patented Storage Kit fits any standard utility truck body and "A" frame derrick and it can be quickly bolted on the back of your truck by your local mechanic. The derrick will go up or down in a minute or less, entirely controlled by the man in the truck cab. Working with a double drum winch, you get live boom operation—or easily adjustable derrick elevation with a single drum winch. The cost is only a fraction of other, more intricate derrick storing systems—and there's no rebuilding of your present equipment! *Write for details.*

Earth Boring Equipment for All Types of Trucks

TEL-E-LECT PRODUCTS, INC.

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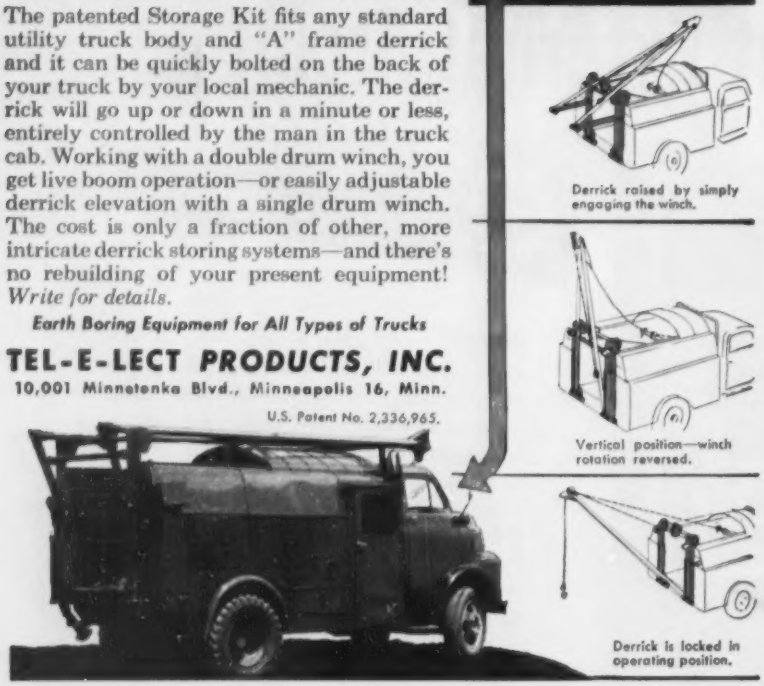
U.S. Patent No. 2,336,965.



Derrick raised by simply engaging the winch.

Vertical position—winch rotation reversed.

Derrick is locked in operating position.

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FPC Victor in Battle Over Wisconsin Project

Wisconsin has lost a contest with the Federal Power Commission for jurisdiction over a small river and the licensing of a hydroelectric power project on it. The Supreme Court refused to step into the state-federal dispute by turning down a request by the state to review the case. The action, in effect, upholds FPC's license to the Winter Electric Light & Power Co for a 400-kw dam at Snap Tail Rapids on the East Fork of the Chippewa River.

The Wisconsin dispute began in 1951 when FPC issued a license to Winter EL&P, basing its jurisdiction on the fact the project would occupy lands of the United States within the Chequamegon National Forest.

Then the Wisconsin State Supreme Court held the federal license was not exclusive and that a state permit for the project was necessary. This decision was based on a finding that half of the proposed dam would be located outside the national forest.

Faced with this ruling and mounting difficulty in condemning land for the project, the company requested FPC to beef up its license by finding that the East Fork is a navigable water and that the project would benefit interstate commerce. FPC later ruled that the East Fork, up to and past Snap Tail Rapids was a navigable river and amended the original license in 1953. The East Fork at the project site is about 110 ft wide and has normal depth of 2½ ft.

Wisconsin fought out the navigability issue in the Seventh Circuit Court of Appeals—and lost. It was this decision the state wanted the Supreme Court to review.

To Build 100,000-Kw Unit

Plans for construction of a new 100,000-kw steam plant have been disclosed by the Salt River Project Agricultural Improvement & Power District, Phoenix, Ariz. Construction on the $13-million plant is expected to start in August, 1955, with completion set for the spring of 1957. The outdoor-type plant will consist of a single 100,000-kw unit with space provided for a second 100,000-kw unit to be added later.

15 years without a circuit failure in 600-mile fire-alarm system

City of Newark helps protect this outstanding record with neoprene-jacketed fire-alarm cable

INSTALLING 25-conductor I.M.S.A. fire-alarm cable jacketed with neoprene. Cable is flexible, easy to handle, can be "soaped" for pulling through conduits without deteriorating.

Not one circuit failure in 15 years is a proud achievement for the fire department of the City of Newark, N. J.— and neoprene-jacketed fire-alarm cable plays a large part in helping to maintain this record. Newark's extensive system has had over 20 years of successful experience with neoprene-jacketed cable and now uses it almost exclusively both for new installations and for replacements.

The extremely difficult service conditions encountered in the Newark System are no threat to tough neoprene-jacketed cable. In 1950, for example, approximately 40,000 feet of this rugged cable were installed in the Port Newark area where the Passaic River empties into Newark Bay. Here, much of this cable is submerged in salt water, strong in industrial refuse and acids. Today, this cable is still in excellent shape . . . is expected to greatly exceed the service life of the metallic-sheathed cable it replaced.

REMEMBER, ONLY NEOPRENE-JACKETED CABLE HAS BALANCED RESISTANCE TO:

- Acids, chemicals, salt water
- Oil and grease
- Electrolytic attack
- Abrasion and chipping
- Sunlight and weathering
- Heat
- Aging
- Flex-cracking

IN CONDUITS, direct in earth or above ground, use neoprene-jacketed cable with confidence. Its flexibility makes handling easier . . . its balanced resistance to deterioration gives long-life installations. Ask your supplier about rugged neoprene-jacketed cable. Available in voltage ratings to suit your needs.

FREE! The Neoprene Notebook. *Each issue describes new, unusual applications of neoprene that will be of interest to you. Just clip and mail coupon to get on the mailing list.*

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Capital Spending Plans for 1955 . . .

Here is Good News About Business Prospects

In 1955, American industry is now planning to spend within 5 per cent of the amount it is spending this year on new plant and equipment. This is the tensely awaited result of a check-up just completed by the McGraw-Hill Department of Economics.

Hundreds of companies, by far the largest number in the eight-year history of these McGraw-Hill surveys, cooperated in the check-up. Combined, they represent 29 per cent of all industrial employment and over 60 per cent of employment in the industries where capital investment is highest. Such a broad cross section constitutes a reliable gauge of the plans of industry as a whole.

PLANS FOR CAPITAL INVESTMENT

	MILLIONS OF DOLLARS			Percent Change 1954-1955
	1953 ACTUAL*	1954 ESTIMATED*	1955 PLANNED	
All Manufacturing	$10,026	$ 9,249	$ 8,598	−7%
Petroleum Industry†	4,600	4,875	4,920	+1
Mining	506	380	311	−18
Railroads	1,312	851	769	−10
Other Transportation and Communications	2,954	2,922	2,640	−10
Electric and Gas Utilities	4,548	4,274	4,206	−2
ALL INDUSTRY	23,271	21,784	20,727	−5

*United States Department of Commerce; Chase National Bank; McGraw-Hill Department of Economics

†Petroleum refining, included under both "All Manufacturing" and "Petroleum Industry," is included only once in the total

What is the meaning of these plans, detailed by the table below, for capital investment next year? Is it good or bad news, so far as it concerns the prospect of continuing prosperity? It is to this crucial question that this editorial is addressed.

Key to Prosperity

It is not only good but very important business news that American industry plans to spend in 1955 almost as much for new plant and equipment as it is spending this year. The reason it is important is that a high level of activity in the capital goods industries is universally recognized as a particularly potent ingredient of prosperity for the nation as a whole. A dollar spent for capital goods is spent again and again for wages and materials. Its stimulating effects, called by economists multiplying effects, move through the economy in much the same way that a pebble tossed into a pond creates a widening circle of ripples. This is one reason why there is such intense business interest in the surveys of plans for capital investment.

Here are the principal reasons why the results of the McGraw-Hill survey are a good omen for continuing prosperity:

1. American industry is demonstrating that it does not need the stimulus of war-created shortages, or a rearmament boom, in order to maintain a very high level of capital investment.

The slight decrease now planned for 1955 will still maintain a level only about 11 percent below the all-time peak attained in 1953 under the stimulus of a defense expansion boom.

2. Capital investment promises not merely to stabilize at a high level, but actually to increase as 1955 goes on and thus give renewed stimulus to business.

The level of investment now planned for 1955 by *industry* — manufacturing, petroleum, mining, transportation, communications and utilities — is within 5 per cent of 1954. Contract awards for *commercial* construction — stores, office buildings, warehouses and other service establishments — as compiled by the McGraw-Hill publication ENGINEERING NEWS-RECORD, indicate a substantial increase in 1955. Thus total capital expenditures by *all business* may be very close to this year's total.

Actually, in the fourth quarter of 1954, business capital expenditures, as reported to the U. S. Department of Commerce, are down about 2.5 per cent from the average for the year as a whole. So there is a good chance that during 1955 the annual rate of capital investment will rise above this present level.

Effect of Tax Changes

The plans reported by the McGraw-Hill survey are preliminary plans, reported at the beginning of the period of business budgeting for 1955. As budgets are completed, new projects may bring the total expenditure that is planned even closer to this year's figure and thus make an even greater contribution to continuing prosperity.

But it also cannot be too strongly emphasized that these are plans; they are not accomplished investments. As such they have the vulnerability to changed conditions that characterize any plans.

There is some indication in the results of the McGraw-Hill check-up that one change in conditions recently made by the United States government has had an important stimulating effect on plans for business investment next year. It is a liberalization of the allowances for depreciation. Apparently encouraged by this provision, most of the smaller companies are planning to maintain or increase their purchases of new equipment next year, whereas during the past three years their expenditures have been declining. This is obviously a development that strengthens our economy.

A government insensitive to the key importance of capital investment by business, both in providing prosperity and in raising our standard of living, might easily destroy the present plans. One of the easiest and surest means to do this is excessive taxation of business profits which are the key ingredient of business investment. Whether the extraordinarily constructive program recently enacted by the federal government in the field of business taxation can be sustained remains to be seen. **If it can be sustained, the remarkably cheering plans of business for capital investment in 1955 can readily become firm foundations for a continuing prosperity.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of 60,000 KVA alternating current generators and delivery thereof f.o.b. Massena, New York, until 10:30 A.M. Eastern Standard Time on the 6th day of January, 1955 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be entertained for 4, 8, 12 or 16 generators and associated equipment and services in accordance with the bidding schedules. Erection at the site of installaton will be done by others but services of erection engineers shall be provided by the manufacturer if and when required.

Bids will not be restricted to American manufacturers.

Plans, specifications and proposal forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and proposal forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 19, 1954 upon application and prepayment of a fee of Twenty-five ($25.00) dollars per set of two bound copies of Contract Documents, no part of which will be refunded.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Guarantee will be required with each bid in an amount not less than 10 percent of the maximum price bid for any bid schedule.

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NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of 71,000 HP hydraulic turbines and delivery thereof f.o.b. Massena, New York, until 10:30 A.M. Eastern Standard Time on the 5th day of January, 1955 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be entertained for 4, 8, 12 or 16 turbines and associated equipment and services in accordance with the bidding schedules. Erection at the site of installation will be done by others but services of erection engineers and mechanics shall be provided by the manufacturer if and when required.

Bids will not be restricted to American manufacturers.

Plans, specifications and Proposal Forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 15, 1954 upon application and prepayment of a fee of Fifteen ($15.00) dollars per set of two bound copies of Contract Documents, no part of which will be refunded.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Guarantee will be required with each bid in an amount not less than 10 percent of the maximum price bid for any bid schedule.

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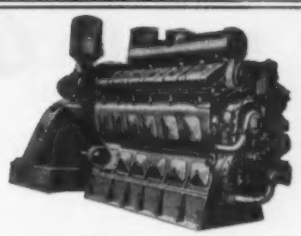

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OFFICIAL PROPOSALS

Bids: December 17, 1954

Construction of Construction Power Facilities

POWER AUTHORITY OF THE STATE OF NEW YORK
NEAR MASSENA, ST. LAWRENCE COUNTY, NEW YORK
SPECIFICATION NO. PA-5-14036
ST. LAWRENCE CONTRACT NO. 7

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the construction of construction power facilities near Massena, St. Lawrence County, New York until 10:30 a.m. Eastern Standard Time on the 17th day of December, 1954 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

The principal items of work are:

1. A 115 KV transmission line, 3-phase, single circuit, approximately 3 miles long on H-frame wood poles. The conductors will be No. 3/0 A.C.S.R. The line will also be provided with a static line which will be installed on top of one of the poles of the H-frame and strung the whole length of the line.
2. Approximately 3.7 miles of double circuit, 3-phase 13.8 KV transmission line on H-frame wood poles. The six conductors for this line will be 336,400 circular mil A.C.S.R.
3. A 115-13.8 KV substation consisting of erection of two 10,000 kva, 3-phase, oil-filled transformers, and necessary bus work, disconnecting switches and fuses for six 13.8 KV, 3-phase circuits. The structure to be furnished by the Contractor for this installation may be either wood or steel.
4. Two 13.8 KV load centers consisting of 3 3-pole, gang-operated pole top mounted load break switches and bus work arranged to receive two incoming 13.8 KV, 3-phase circuits. The structure will be wood.

Plans, specifications and Proposal Forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 19, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 26, 1954 upon application and prepayment of a fee of Twenty-five ($25.00) dollars, no part of which will be refunded.

Bids must be made upon the proposal forms included in the Contract Documents. Each proposal must be accompanied by draft or certified check payable to the order of the Power Authority of the State of New York for the Sum of $15,000.00.

The right is reserved to reject any or all bids.

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1— 400 H.P., West., CW. 450 RPM. 550V.
1— 250 H.P. West., CW, 600 RPM. 440V.
1— 200 H.P., West., CW. 600 RPM. 440V.
3— 150 HP., Al. Ch. 1800 RPM. 2300V., 3PH. 60 Cy.

Large Stock of A.C. and D.C. Equipment

TRANSFORMERS

FOR SALE

6—1000 KVA Mol 11500-2400/4160Y
3— 833 KVA G-E 35000—480
3— 500 KVA G-E 26400—240/480
5— 333 KVA W-H38000-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/-11950Y
3— 333 KVA G-E 33000-2300/4000Y
3— 333 KVA Mol 7200/12470Y-2500/4160Y
9— 200 KVA W-H 13200-230/460
3— 150 KVA G-E 19050/33000Y-2540/4000Y
5— 150 KVA G-E 7200/12470Y-240/480
3— 100 KVA G-E 33000-6900/11950Y
3— 100 KVA G-E 4000-115/230

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

40 Years Dependable Service

FOR SALE

Electric Dispatcher's Diagram

Manufactured by Leich Electric Company, Genoa, Ill., 22 ft. long, 11 ft. high. Face equipment 1" squares. Dial operated 24 volt lamps. Available about January 1, 1955.

Contact Manager, Real Estate Department, Pennsylvania Power & Light Co., Allentown, Pa.

RE-NU-BUILT
GUARANTEED

ELECTRIC POWER EQUIPMENT

MOTOR GENERATOR SETS
3 ph., 60 cy.

Qu.	KW	Make	Speed	DC Volts	DC Volts
1	3000 3U	G.E.	514	600	4000/12200
2	2000/2400	G.E.	450	250/300	2300/4600
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	666 25 cy.	11000
2	2000	G.E.	450	600	2300/4600
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1000	G.E.	900	260	4100/6900
3	1000	G.E.	720	600	2300/4600
2	750	G.E.	720	275	2300/4600
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	1000	Moore	Condensing — Extraction — 190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn Exciter
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	12000	Whse.	60/25	13200 x 12200
1	3750	G.E.	60/25	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2200
1	625	A.C.	25/60	11000 x 2300

TRANSFORMERS—60 Cycle

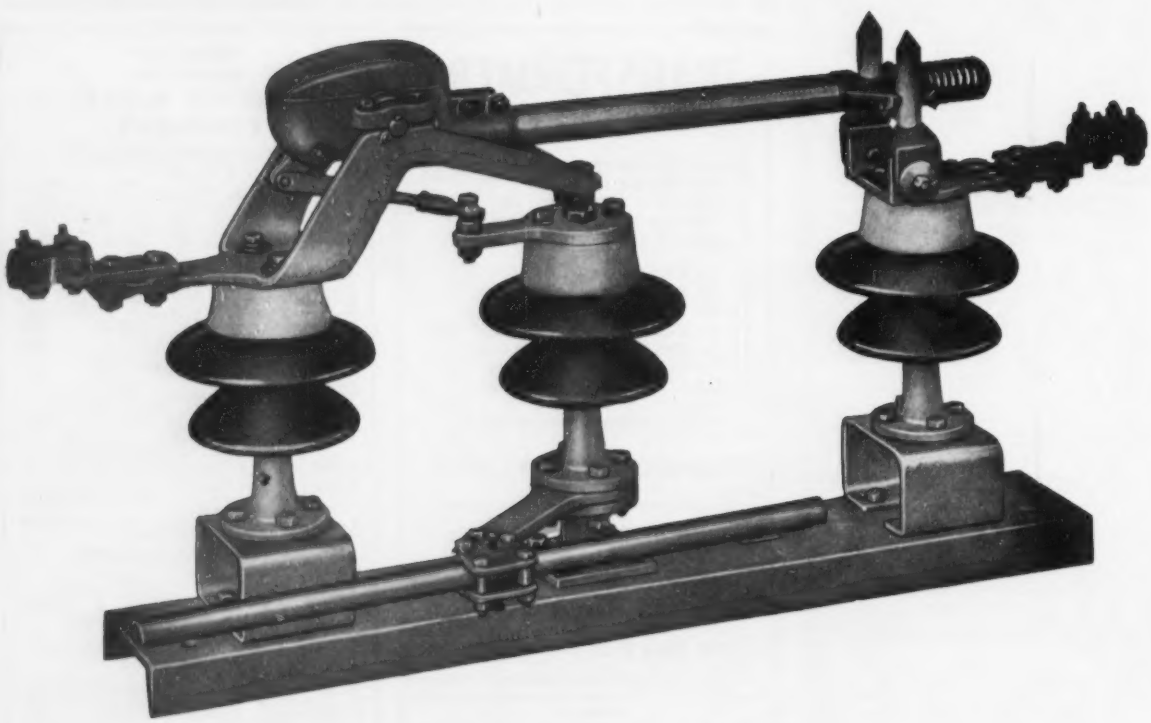
KVA	Make	Type	Ph	Voltages
1	5000	Whse.	OISC	3	23000x26400/13200
1	2500	Whse.	OISC	3	26400/13200 x 480
2	2000	G.E.	HVDDJ	1	66000 x 13800
3	667	G.E.	HD	1	13800 x 2300
3	1250	G.E.	HVDDJ		6600/550
3	1000	G.E.	HVDDJ	1	2300/460

BELYEA COMPANY, INC.
51 Howell Street, Jersey City 6, N. Y.

Cole Electric Co.

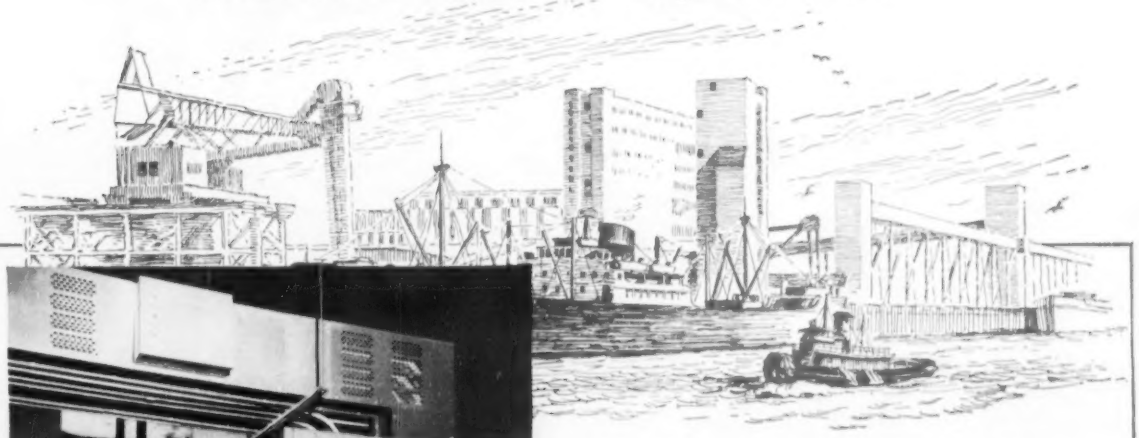
8439 Steller Drive TExas 0-4701 Culver City, Calif.

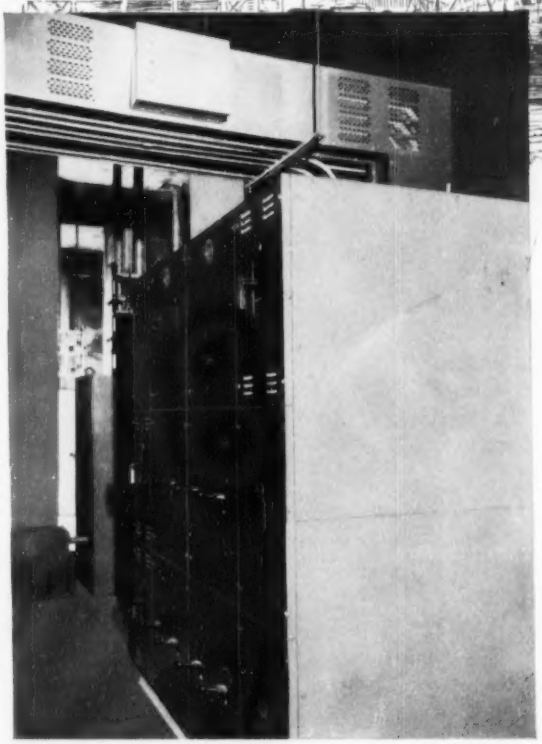
Tests made in our laboratory under severe icing conditions show the switch illustrated below, closed (left) and after opening (right). Ice was over 1" thick: Only 450 inch pounds were required to open switch.

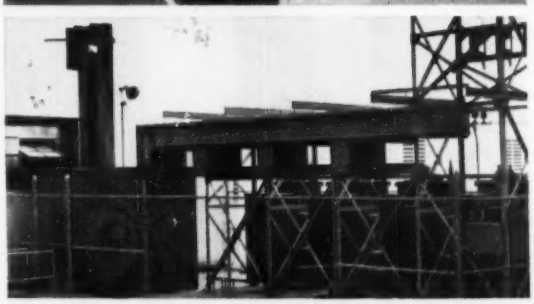


AIR BREAK DISCONNECTING SWITCH
15,000 volts, 600 Amperes, Type 0-2
Vertical Break, Three Pole, Single Throw, Group Operated
SILVER TO SILVER CONTACTS

FOR TODAY'S MOST MODERN GRAIN ELEVATOR, FEDERAL PACIFIC EQUIPMENT







At left; top: Federal Pacific Low Impedance Bus Duct feeding from Distribution Switchboard. Bottom: Transformer top outlets with Service Duct to outdoor Switchgear . . . Electrical construction by Fischbach & Moore, Inc., Victory Electric Works, New Orleans. General contractor, Fegles Construction Co., Inc., Minneapolis. Engineers, Jones-Hettelsater Co., Kansas City.

THE RECENTLY COMPLETED New Orleans Public Grain Elevator has an extensive "hazardous location" electrical system for which Federal Pacific has supplied the distribution equipment. From the outdoor substation, Federal Pacific Service Duct carries electric energy into the main building where Low Impedance Duct feeds six distribution center electric rooms on different levels. Throughout the main building, silo storage section, conveyor belt ramps and the handling and ship-loading equipment in buildings along the dock, Federal Pacific Switchgear and Safety Switches help facilitate the handling of an average of seven million bushels of grain per month.

Federal Pacific electrical equipment for light and power is today's top specification. Most of this equipment is economically assembled from standard units . . . and it is designed and engineered for easy installation, complete efficiency and ready adaptability for future changes.

Submit your electrical distribution problems to Federal Pacific for study and suggestions. Write Federal Pacific Electric Company, 50 Paris Street, Newark 1, New Jersey.

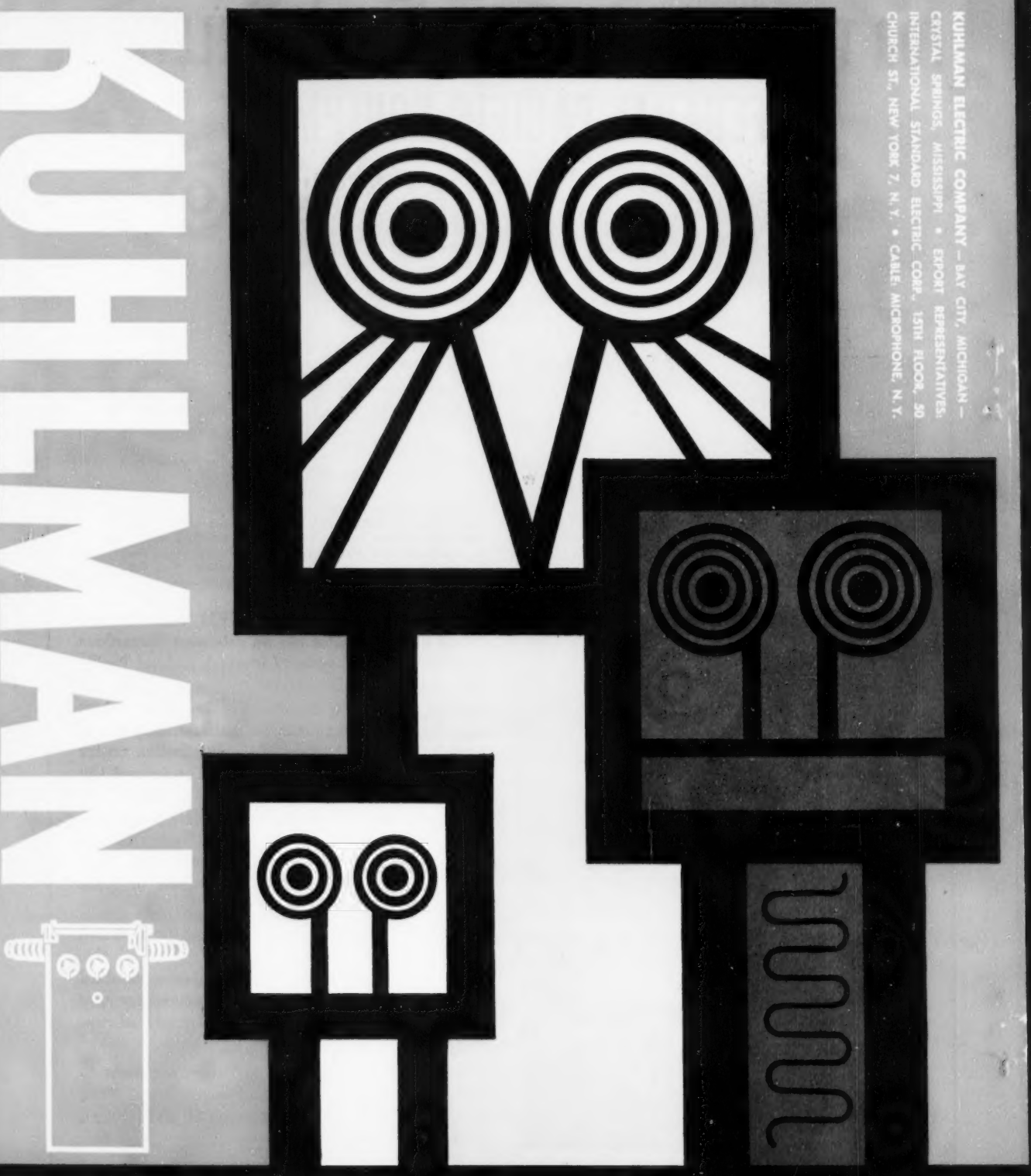
FEDERAL PACIFIC ELECTRIC CO.

FORMERLY—FEDERAL ELECTRIC PRODUCTS COMPANY AND PACIFIC ELECTRIC MANUFACTURING CORP.

Main Office: 50 PARIS STREET, NEWARK 1, N. J.

Federal Pacific products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct, High voltage circuit breakers and power switches ★ Sales offices in principal cities.

KUHLMAN



KUHLMAN ELECTRIC COMPANY – BAY CITY, MICHIGAN –
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LARGE OR SMALL, KUHLMAN DISTRIBUTION TRANSFORMERS
FAITHFULLY KEEP WATCH OVER THE FLOW OF ELECTRICAL ENERGY